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WORLD MARITIME UNIVERSITY

Dalian, China

**MARITIME SAR FOR EMERGENCIES
RELATED TO FISHING BOATS IN QINGDAO
WATERS**

By

Shi Chuanzhu

The People's Republic of China

A dissertation submitted to the World Maritime University in partial
Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

In

MARITIME AFFAIRS

(MARITIME SAFETY AND ENVIRONMENT MANAGEMENT)

2020

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DECLARATION

I certify that all the materials in this dissertation that are not my own work have been identified and that no material is included for which a degree has previously been conferred on me.

(Signature):

(Date):

Supervised by:

Professor

Dalian Maritime University

Assessor: _____

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Special thanks to the fishermen who assisted me in completing the surveys: Song Qiang, Wang Hailong. Forgive me for not being able to list all of your names here. You fight with the billows with extraordinary courage to provide people with the

necessary seafood. You are true heroes. I am honored to be able to call you "friends" for the rest of my life.

Finally, I wish to devote this paper to my beloved family, who have been supporting me in the past years. Because of your presence, I have never been afraid when encountering difficulties.

ABSTRACT

Title of Research paper: **Maritime SAR for Emergencies Related to Fishing Boats in Qingdao Waters**

Degree: **MSc**

In recent years, the maritime SAR of fishing boats has become the most important part of the daily work of SAR centers. Fishing boats are generally relatively small in size and have a large crew. After a dangerous situation occurs, they tend to deteriorate rapidly, leading to heavy casualties. This issue has aroused extensive discussion among scholars, and the SAR centers have also done a lot of research, but so far, there have been few obvious results.

This paper combs the current situation of Qingdao Maritime SAR Center, including organizational structure, SAR force, etc., uses various methods to investigate the reasons for the frequent occurrence of fishing boats related emergencies and rescue difficulties and points out deficiencies in the current SAR mechanism and the allocation of SAR forces. In addition, base on the analysis of relevant cases, and the results of investigations, some suggestions to improve the success rate of SAR were put forward.

This thesis uses a variety of research methods, including literature review, data analysis, and telephone questionnaire surveys.

KEYWORDS: Fishing boats, Fisherman, SAR, Emergency

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LIST OF ABBREVIATIONS

AIS	Automatic Identification System
BRB	Beihai Rescue Bureau
DFT	Department for Transport
IMO	International Maritime Organization
MCA	Maritime and Coastguard Agency
MRCC	Maritime Rescue Coordination Center
MRSC	Maritime Rescue Sub Center
MOB	Man Overboard
MSA	Maritime Safety Administration
NSA	National SAR Agency
NSARC	National SAR Committee
PSC	Port State Control
RCC	Rescue Coordination Center
RLSS	Royal Life Saving Society
RNLI	Royal National Lifeboat Institution
RSC	Rescue Sub Center
SRR	Search and Rescue Region
SSB	Single Side Band
USCG	United States Coast Guard
VTs	Vessel Traffic Service

CHAPTER 1 INTRODUCTION

1.1 Background

Nowadays, the development of fisheries has become an important economic pillar of China, not only providing a large number of employment opportunities but also providing people with essential seafood. According to statistics, the total output value of China's fishery economy in 2019 was 2,640,650 million yuan, with a total of 731,200 fishing boats and a total tonnage of 10.402 million tons at the end of 2019 (Ministry of Agriculture and Rural Affairs, 2019). While creating great value, fishermen have endured huge risks, including injuries and illnesses, collisions with commercial boats, and natural disasters, which have brought huge threats to their personal safety. The working environment of fishermen is often far from the shore, and it is difficult to get a timely rescue in case of injuries and illnesses; The size and horsepower of fishing boats are often small, and the hull rigidity and strength are difficult to withstand higher-level sea winds and waves; Most of the life-saving facilities equipped on fishing boats, no matter in "quality" or "quantity", fail to meet the equipment standards required by fishery departments. These reasons make fishing still remains the most hazardous occupation at sea (IMO, n.d.).

During the six years from 2014 to 2019, in Qingdao waters, a total of 176 emergencies occurred, among which 143 involving fishing boats, accounting for a large proportion of the maritime SAR cases. It is no exaggeration to say that the rescue of fishing boats is the key point of maritime SAR.

1.2 Objectives

This thesis uses methods such as the collation and analysis of literature and questionnaire surveys to gain insight into the law of incidents on fishing boats at sea

and the current situation of fishing boats related SAR in Qingdao's jurisdiction; Combining with the rescue process of recent maritime fishing boats related SAR cases, analyze the problems existing in the current fishing boat rescue system; Based on the relevant theoretical analysis of maritime SAR, methods, and approaches are proposed to increase the rescue success rate and reduce the loss of life and property.

The main research objectives specifically include:

- (1) Clarifying the existing problems in the current SAR mechanism;
- (2) Combining relevant theories such as multi-subject cooperation and referring to the construction experience of foreign maritime SAR management mechanisms, put forward the construction ideas to give full play to maritime SAR capabilities;
- (3) Optimizing the rescue process from the three levels of the government (including the professional rescue forces), public participation forces, and the fishing boats themselves;
- (4) Giving full play to the rescue function of each rescue entity and increasing the rescue success rate of emergencies on fishing boats.

1.3 Current studies

1.3.1 The composition of the maritime SAR system in China

In 1989, in order to unify and coordinate the SAR forces, the "China Maritime SAR Center" was established. Nowadays, the "National Maritime SAR Joint Conference" composed of relevant ministries and commissions of the State Council and relevant military departments, is responsible for coordination. As shown in Figure 1, since 2013, a new round of State Council institutional reform has been gradually launched, and China's SAR system has also been adjusted accordingly.



Figure 1-China's Maritime SAR System

Source: Updated from Prof. Jean-Charles CORNILLLOU's PPT.

At present, scholars have conducted research and summary on the maritime SAR system mainly from the management system, organization system, and SAR structure. Dang (2012) pointed out from the management system that after years of reform of the national rescue system, professional rescue agencies such as the North Sea Rescue Bureau, East China Sea Rescue Bureau, and South China Sea Rescue Bureau were established in 2003, and then the National Maritime SAR Joint Conference System was set up. Since then, the formation of the maritime SAR force of "the combination of the army and the local government, the combination of experts and the masses" has gradually formed. Xu (2007) supposed that the national maritime SAR emergency organization and command system consists of the emergency leadership agency (National Maritime SAR Inter-ministerial Conference), operation management agency (China Maritime SAR Center), consulting agency, and emergency command agency (provincial maritime SAR agency), on-site command, emergency assistance, etc.,

forming a top-down hierarchical system. Huang (2010) integrated the leading command organization and the subordinate organization components and divided the maritime SAR organization into various levels of maritime SAR centers, maritime management agencies, and other maritime SAR organizations in terms of organizational structure, professional forces, and social forces. Peng (2007) subdivided the maritime SAR forces into professional rescue forces, public SAR forces, maritime SAR forces, military, and armed forces. What was different from the past was that the forces of the government and the army were separated from the public force. Ren et al. (2010) divided the maritime rescue forces into maritime monitoring systems, maritime safety communication systems, and maritime emergency response teams (equipment and facilities) from a macro perspective such as the operational mechanism of emergency management. Pei (2014) introduced and studied China's maritime SAR operation mechanism from the aspects of maritime SAR emergency response procedures. Cui (2015) put forward the “three-in-one” rescue mechanism when studying China's maritime SAR, and elaborated and analyzed its formation and development, advantages and scientificity, professional team building, and rescue performance.

1.3.2 The main problems in China's maritime SAR system

Although China's maritime SAR has achieved remarkable results in recent years, there are still some problems in the SAR mechanism, especially in the SAR system (a division of functions of SAR command coordination organizations), laws and regulations, and other legislative support, funding and equipment and social mobilization mechanism.

Peng (2006) pointed out some shortcomings of the current maritime SAR work in terms of the organization and coordination of emergency SAR, material guarantee,

legal system, and the "quality" and "quantity" of professionals. Xu (2009) explored the disadvantages of diversified SAR in the analysis of the characteristics of the maritime SAR system. In terms of organizational structure, the unclear nature of maritime SAR centers and the weakened functions of MSAs had become obstacles in the coordination of SAR work. Wang (2012) incorporated the rescue of maritime emergencies into the emergency management system. From the perspective of emergency management, he pointed out four major problems that emerged in the construction of maritime emergency mechanisms: the operability of the contingency plan was not strong enough, the management mechanism was not smooth, the emergency response force, and basic conditions were weak. Wang & Sha (2012) compared the experiences of developed countries in the world, pointing out that China and other developed countries still have gaps in the allocation of hardware equipment, professional capabilities of SAR personnel, and management mechanisms. Shi (2017) supposed that there were still problems in China's maritime SAR emergency command system, relevant regulations and SAR plans, construction of the three-dimensional rescue system, and the acceptance and transmission of maritime distress information. Liu (2018) pointed out the current SAR problems in terms of SAR forces, SAR laws, and SAR awareness based on the maritime SAR process and related SAR cases when studying the current situation and countermeasures of Zhoushan's maritime SAR.

1.3.3 Measures to improve the maritime SAR system

Regarding the various problems that exist in China's maritime SAR system, scholars have focused on the establishment of maritime SAR emergency operation mechanisms and the formulation of emergency plans, the improvement of maritime emergency SAR laws and regulations, and the guarantee of materials, especially the establishment of public finance and incentive mechanisms, putting forward countermeasures and suggestions to improve China's maritime SAR system.

Scholars such as Liu & Zhou (2011) paid attention to the role of the command system and discussed in detail the definition and division of functions between maritime SAR centres and maritime management agencies. Wang & Sha (2012) emphasized the role of people and proposed improvement measures from five aspects: human, team, equipment, management, and legal system, which had a certain effect on improving China's maritime SAR system and increasing the success rate of SAR operations. In terms of the operational mechanism of emergency management, Tang (2013) took Shanghai as an example to study the issue of level selection in the preparation of emergency plans for maritime emergencies and proposed that local governments should choose emergency responses according to the degree of harm of different emergencies within their jurisdiction. Guo (2013) analyzed the response to maritime emergencies from the perspective of emergency management and made suggestions for the formulation, implementation, and evaluation of emergency plans for relevant maritime departments. Xing (2012) explored the optimization model and simulation research of three-dimensional maritime search and advocated that the utilization rate of rescue forces should be optimized through the method of three-dimensional maritime SAR. Wang (2012) proposed to strengthen the construction of maritime SAR air power by comparing China and the United States' maritime rescue air power. Huang (2014) conducted research on China's maritime SAR system innovation, analyzed influencing factors, discussed basic principles, and proposed countermeasures. Shi (2017) supposed that perfecting China's maritime SAR system required further optimization of the maritime SAR structure, more investment in equipment and technology, and establishment of a special maritime SAR education and training system.

1.3.4 Shortcomings of existing research

Although many scholars are paying attention to these problems and have done a lot of research on it, most of the research did not consider the roots of the problem in-depth, and the solutions proposed are divorced from reality and are often not operable. For example, Lin (2010) suggested strengthening the construction of professional rescue power for maritime SAR, such as helicopters and professional rescue ships. In the long run, this will, of course, be an effective approach. However, China is still a developing country. In the central and western regions, many important parts, such as education and medical care, are still very weak. From the perspective of the entire country, consuming more resources to build professional SAR forces is not necessarily an efficient Way.

1.4 Methodology

As shown in Figure 2, the research methods adopted in this paper mainly include:

(1) Literature research.

By referring to related research results such as journals and books, the author classified and categorized the research results of domestic and foreign maritime rescue, maritime rescue mechanisms and fishing boat rescue, to provide detailed information for research and improve the scientific and pertinence of countermeasures;

(2) Questionnaire survey method.

Telephone questionnaire surveys were used to understand the reasons for the high risk of fishing boats and the low success rate of SAR, and to understand the rescue needs of fishermen;

(3) Data analysis method. Relevant data was obtained through the analysis of fishing boat SAR cases in recent years, and graphs were used to analyze these data in order to explain the situation of fishing boats at sea in more detail and intuitively.

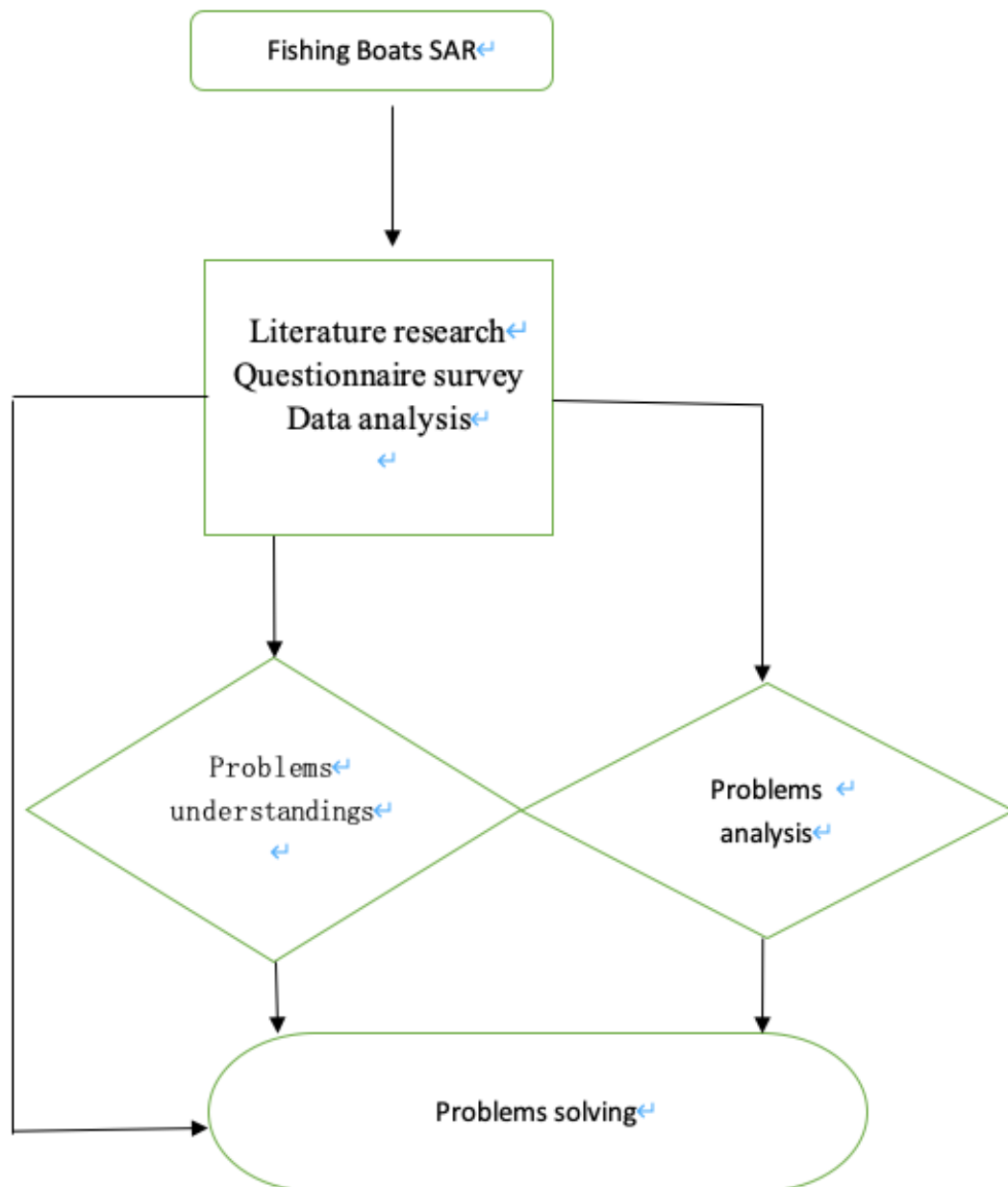


Figure 2–Methodology of this thesis
Source: Author.

1.5 Structure of the paper

This dissertation consists of five chapters, followed by two appendices.

The second chapter introduces the basic content of the current work of the Qingdao Maritime SAR Center, including the emergency management system and the general situation of the jurisdiction; Statistics and data analysis on the emergencies of fishing boats in recent years are conducted. The third chapter discusses the current shortcomings of Qingdao SAR from several aspects, such as the SAR system, the configuration of rescue forces, and the equipment of fishing boats. Chapter 4 puts forward some suggestions for improvement on existing problems; Chapter 5 analyzes the deficiencies of this paper and makes some prospects.

CHAPTER 2 The current situation of the maritime SAR of fishing boats in Qingdao

2.1 General situation of SAR management in Qingdao

2.1.1 Maritime SAR management system

The Qingdao Municipal Government established Qingdao Maritime SAR Center as the command agency for maritime SAR. The SAR center is under the guidance of the Shandong Maritime SAR Center in business. The Office of the Municipal SAR Center is located in Qingdao Maritime Safety Administration, the director of the office is the deputy director of Qingdao MSA, and the deputy director is the director of Qingdao MSA Command Center. At the same time, the Qingdao Municipal Public Security Bureau, the Municipal Ocean Bureau, and Fisheries Bureau, the Municipal Meteorological Bureau and the North Sea Fleet, Coastal Police Qingdao Detachment, and the coastal district governments are included in the member units of Qingdao Maritime SAR Center, and the responsibilities of each member unit are specified.

2.1.2 Introduction and responsibilities of Qingdao SAR center

On May 17, 2005, Qingdao SAR center was established. The Qingdao Maritime SAR Coordination Office is set up in Qingdao MSA and is responsible for the specific coordination and command of Qingdao maritime SAR incidents. The duty officers of the VTS center monitor the traffic safety of ships in the jurisdiction and also serve as the SAR coordinator. 0532-12395 is used as the SAR duty phone in Qingdao area and is on duty 24 hours a day.

The duties of Qingdao Maritime SAR Center include: under the leadership of the Municipal Party Committee and Municipal Government, implementing the organization, command and coordination of Qingdao maritime SAR incidents; implementing national and provincial laws, regulations and policies on maritime safety work; organizing, coordinating and directing maritime disaster rescue; anti-tropical cyclone, prevention of ships from polluting the sea and SAR of civil aircraft that have crashed at sea; researching and solving the problems existing in maritime SAR work; Formulating regulations and work plans for maritime SAR work; reviewing the budget for maritime SAR work; propaganda work for maritime SAR to enhance people's awareness of maritime safety and active participation in maritime SAR; strengthening regional cooperation and exchanging SAR experience, etc.

2.1.3 Response procedures for maritime emergencies

The Qingdao Maritime SAR Center evaluates the severity of the danger based on the distress alarm and relevant information collected, and after the approval of the commander-in-chief of the Qingdao Maritime SAR Center (according to the level), the center will announce the emergency phase and take corresponding measures.

(1) Uncertainty phase

At this stage, the SAR coordinator should immediately inquire the basic information of the alarming ship through the shipowner or agent, try to establish communication with the ship and understand the situation of the alarming personnel. If the necessary information is still not available, the ship reporting system and the ship traffic management system can be used to coordinate nearby ships or other maritime SAR centers to assist in the verification. If necessary, issue a navigational warning, and then track and understand the relevant feedback for verifying whether there is danger.

(2) Alert phase

At this stage, duty officers should immediately report to the commander-in-chief of Qingdao Maritime SAR Center (according to the level) and put forward relevant recommendations such as rescue plans, and then implement them in accordance with the instructions or approved plans of the Qingdao Maritime SAR Center Commander-in-Chief, notify relevant rescue units to organize rescue assistance, pay close attention to the progress of the dangerous situation and actively prepare for the implementation of SAR operations.

(3) Distress phase

At this stage, a reasonable SAR plan should be immediately formulated and reported to the commander-in-chief of the maritime SAR center (according to the level), executed by the commander of the center, and then the duty office should immediately notify the standby rescue force to take corresponding actions, track the progress of the SAR, and adjust the action plan in time.

2.1.4 Introduction of Qingdao SAR responsibility zone

As shown in Figure 2.2, the area of responsibility for maritime SAR in Qingdao is:

Northern boundary- the following four points 36°31'49.74" N/121°02'52.6 " E, 36°12'46.32" N/121°23'37.18 " E, 36°19'25.33"N/121°34'19.98 "E and 36°34'00"N/121°30'27.35"E are connected in sequence and extend eastward along the 36°34'00" latitude;

Southern boundary- the following four points 35°35'37.743 " N/119°38'15.161 " E,

35°35'08.741 "N/119°39'35.463"E, 35°34'07.118"N/119° 41'51.888" and 35°27'11.532"N/ 119°50'37.640"E are connected in sequence and extend eastward along the 35°27'11.532"N latitude.

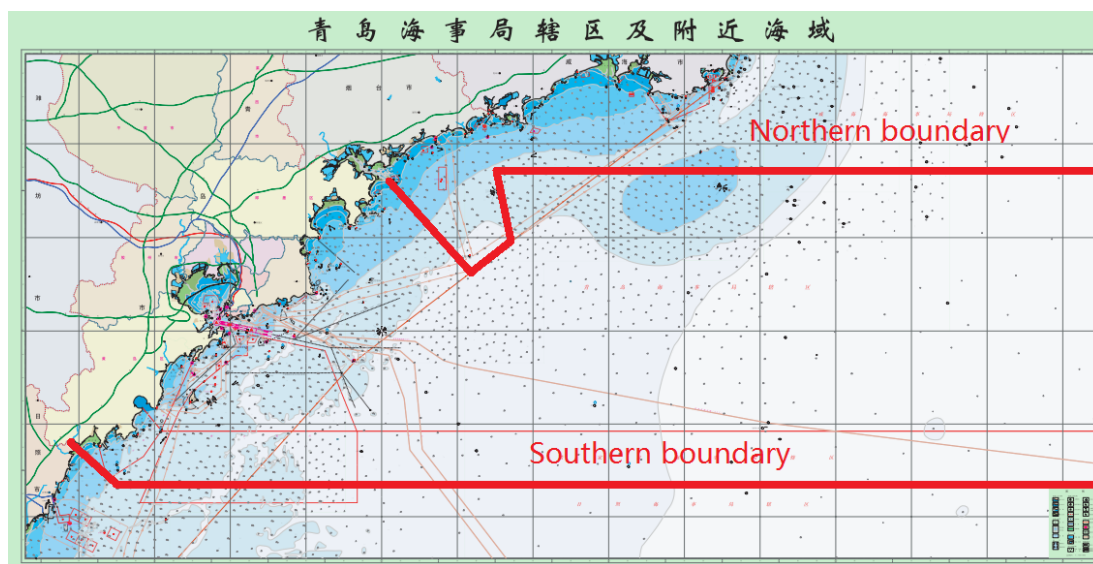


Figure 3-SAR Responsibility Zone of Qingdao
Source: Qingdao MSA.

2.2 Current situation of SAR operations related to fishing boats in Qingdao

2.2.1 Statistics of SAR data related to fishing boats

In order to have a more detailed understanding of the emergencies and SAR conditions related to fishing boats in the Qingdao Maritime SAR jurisdiction, and to improve the success rate of the SAR of fishing boats, the author downloaded and studied all the SAR records related to fishing boats from 2014 to 2019, and analyzed the data collected. After data analysis, the author obtained the proportion of fishing boat emergencies in Qingdao waters, the type of danger, the time of occurrence, the level of danger, the rescue situation and the distribution of emergencies. At the same time, the author also analyzed the characteristics of fishing boats related incidents and rescue

and then found out the existing shortcomings and defects of SAR operations related to fishing boats.

The data in this paper came from the actual statistical data of Qingdao Maritime SAR Center. The author established a database of SAR cases related to fishing boats based on the statistical data and used the functions of the database for data statistics.

(1) Analysis of the proportion of fishing boats related emergencies over the years

As shown in Figure 4, during the six years from 2014 to 2019, a total of 176 incidents of various emergencies occurred, of which a total of 143 incidents involving fishing boats occurred, accounting for 81.25%. Through data analysis and comparison, it can be found that the proportion of fishing boats related emergencies is very high, and the success rate of fishing boats directly determines the success rate of maritime SAR in Qingdao jurisdiction.

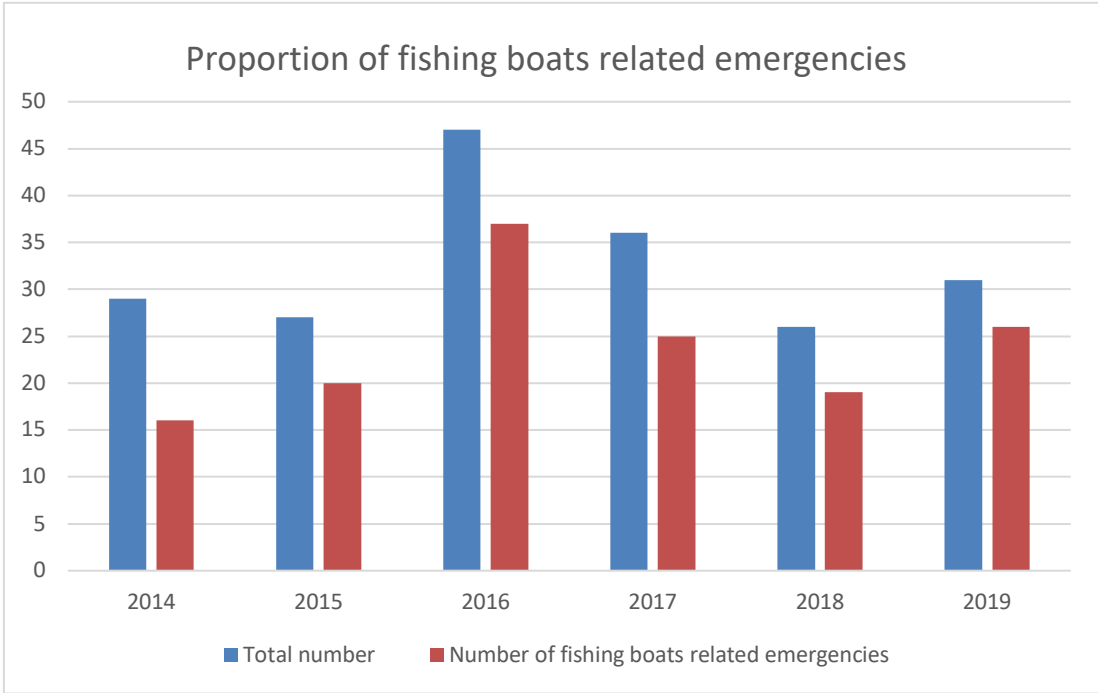


Figure 4-Proportion of fishing boats related emergencies

Source: Created by Author according to data from Qingdao MSA.

(2) Analysis of the proportion of people in distress on fishing boats

As shown in Figure 5, among the 176 distress situations from 2014 to 2019, a total of 859 people was involved, of which 482 people were in distress involving fishing boats, accounting for 56.11%. In addition, as shown in Figure 6, in recent years, with the upgrading of equipment onboard merchant ships, and various port states have become more and more stringent in inspections of merchant ships, there are fewer and fewer emergencies related to merchant ships, and then the proportion of people in distress on fishing boats has increased accordingly.

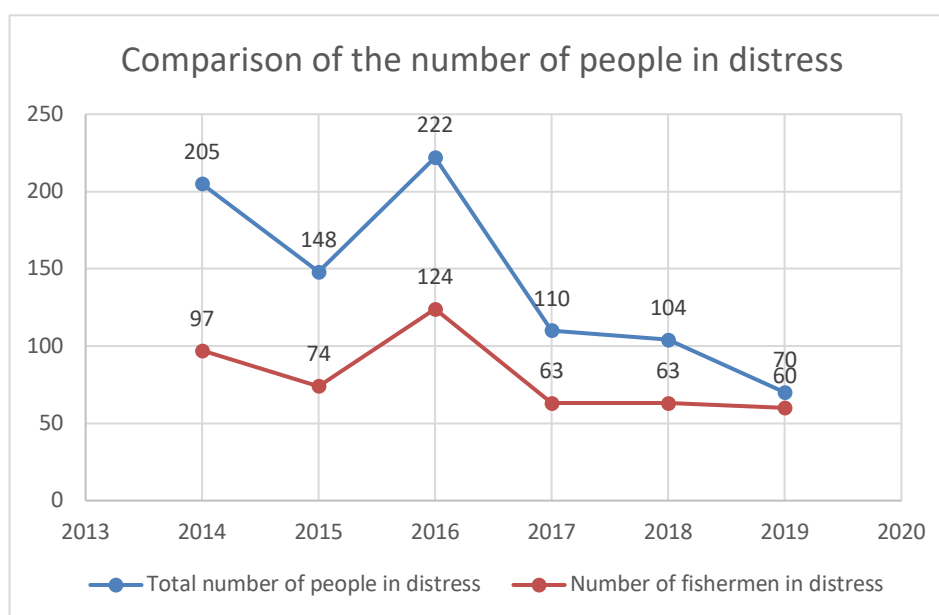


Figure 5-Comparison of the number of people in distress

Source: Created by Author according to data from Qingdao MSA.

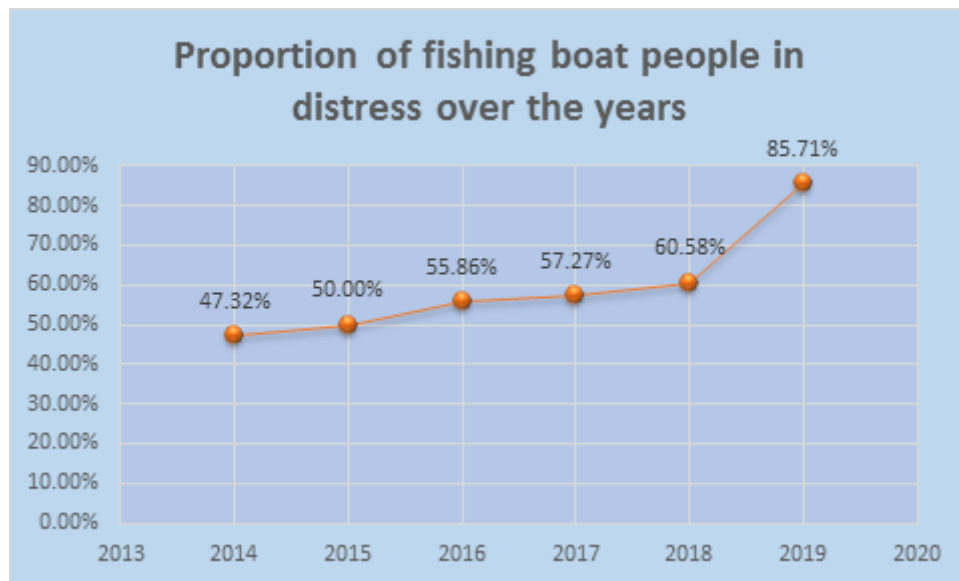


Figure 6-Proportion of fishermen in distress

Source: Created by Author according to data from Qingdao MSA.

(3) Statistical analysis of the types of emergencies related to fishing boats

Fishing boat emergencies that occurred in Qingdao waters involved many types, including injuries and illnesses, MOB, collisions, stranding, sinking, and fires. The statistical results of the types of emergencies in the Qingdao Maritime SAR jurisdiction from 2014 to 2019 are shown in Figure 7.

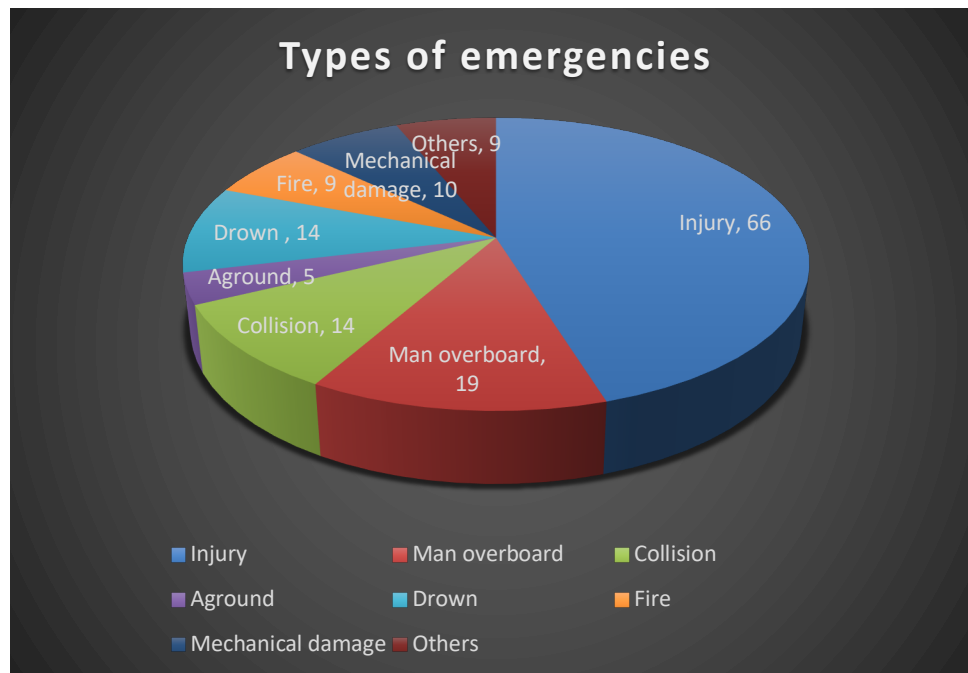


Figure 7-Types of emergencies related to fishing boats

Source: Created by Author according to data from Qingdao MSA.

From Figure 7, we can find that among the fishing boats related hazards that have occurred in Qingdao's jurisdiction in the past six years, the most frequent occurrence is a total of 65 cases of personal injuries, accounting for 45.45%; The second is 18 cases of MOB, accounting for 12.59%; There were 14 collisions and self-sinking of boats respectively, each accounting for 9.79%; There were ten machine failures, accounting for 6.99%; 9 fires, accounting for 6.29%; There were five strandings, accounting for 3.49%; 9 other cases, accounting for 6.29%. Through the analysis of the types of emergencies, we can allocate SAR resources more reasonably. For example, we should devote more resources to the rescue of personnel injuries.

(4) Statistical analysis of the time of emergencies related to fishing boats

The area of responsibility for maritime SAR in Qingdao is relatively large. There are so many fishing boats operating there. The operation of fishing boats and the sea climate are greatly affected by time and season. As shown in Figure 8, the author made

statistics on fishing boats related to emergencies from 2014 to 2019 by month.

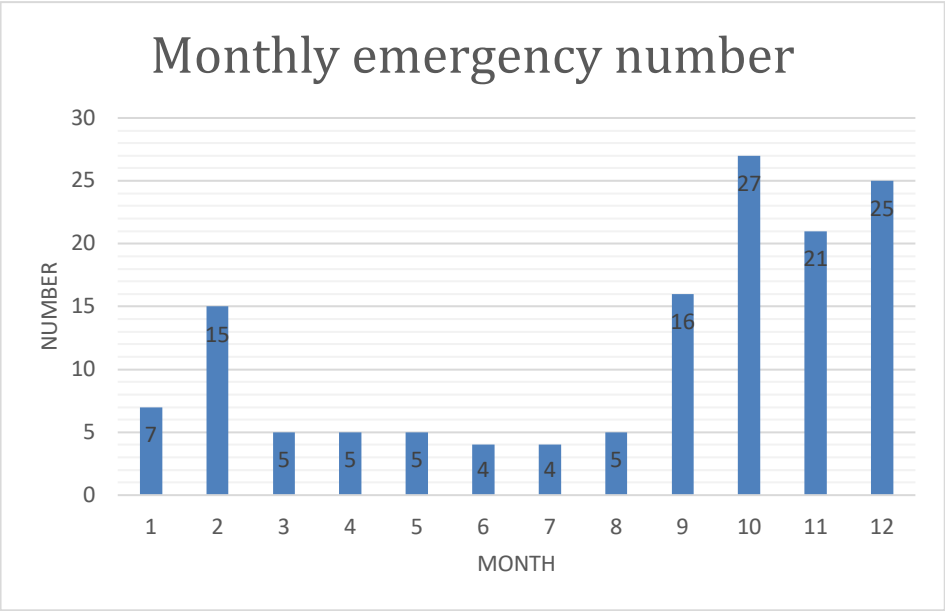


Figure 8-Monthly emergencies related to fishing boats

Source: Created by Author according to data from Qingdao MSA

From May to August each year, the fishing period in Qingdao waters is closed. It can also be seen from Figure 2.6 that there are fewer fishing boats related to emergencies in Qingdao from May to August. However, the number of emergencies has increased significantly after the fishing moratorium. On the one hand, there will be an obvious fishing peak after the fishing moratorium; on the other hand, because the cold winter wave and strong winds begin in October, severe weather and sea conditions increase. Fishing boats related emergencies also occur during the fishing moratorium, which shows that there is still illegal fishing during the fishing moratorium, therefore, regulatory authorities need to do more. If divided by quarter, it can be seen that most emergencies occurred in the fourth quarter, as shown in Figure 9.

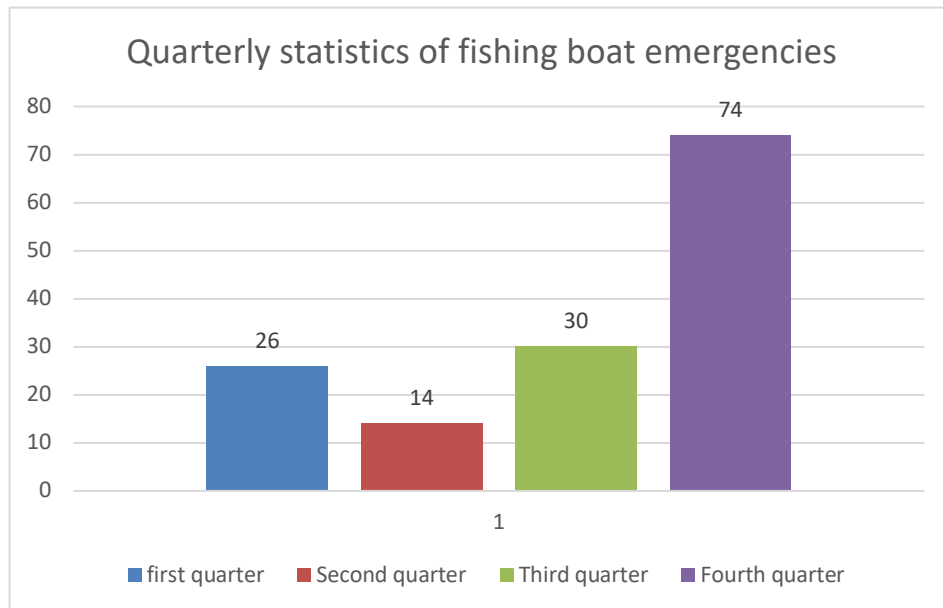


Figure 9- Quarterly statistics of fishing boat emergencies

Source: Created by Author according to data from Qingdao MSA.

(5) Statistical analysis of the level of emergencies related to fishing boats

On January 22, 2006, the State Council of the People's Republic of China promulgated the National Maritime SAR Contingency Plan. According to the relevant national regulations on the reporting of emergencies and risks, combined with the characteristics of maritime emergencies and the degree of hazard to human life and the maritime environment caused by emergencies, the information on maritime emergencies was classified to four levels: very serious, serious, general and slight. After receiving the dangerous information of the maritime emergencies, relevant maritime SAR centers should analyze and verify the dangerous information and report it according to the relevant regulations and procedures according to different levels. As shown in Figure 10, during these six years, 122 slight emergencies occurred, accounting for 85.31%; A total of 19 general emergencies occurred, accounting for 13.29%; 2 serious emergencies occurred, accounting for 1.39%; there was no very serious emergency.

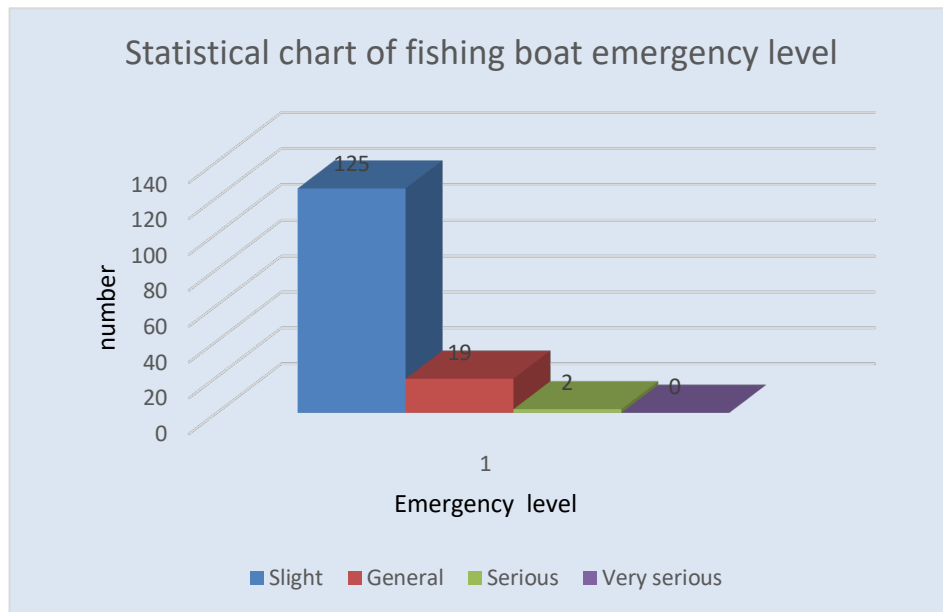


Figure 10-Emergency level of fishing boats

Source: Created by Author according to data from Qingdao MSA.

According to the above data analysis, as far as a single risk is concerned, the risk related to fishing boats has the characteristics of low level and small scale. However, according to the previous analysis, whether the number of fishing boats in danger or the number of crewmembers in distress, both occupy the most important part of maritime SAR. This explains the relatively scattered characteristics of fishing boats in danger and puts forward higher requirements for the reasonable arrangement of SAR forces.

(6) Statistical analysis of the SAR success rate related to fishing boats

As shown in Figure 11, the overall SAR success rate in Qingdao's jurisdiction has reached 94.8% in recent years, while the SAR success rate of fishing boats has only reached 81.95%. In addition, the deaths and disappearances of people in distress on fishing boats accounted for 18.5%. This shows that the rescue work of fishing boats is in urgent need of improvement.

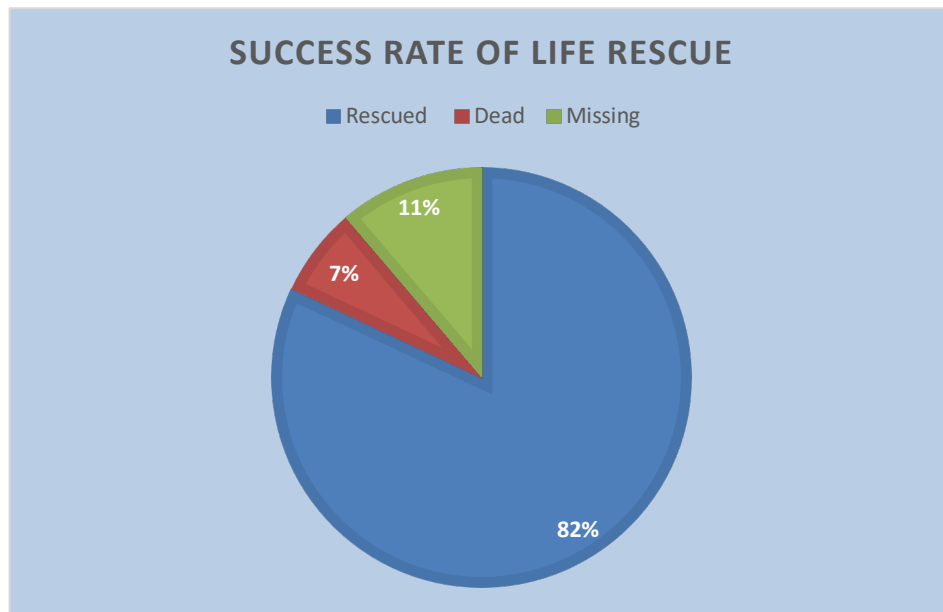


Figure 11-Success rate of life rescue of fishing boats

Source: Created by Author according to data from Qingdao MSA.

(7) Statistical analysis of the areas where fishing boats emergencies occurred

The location of an emergency is an important factor in the success of maritime SAR. As shown in Figure 12, the author has calculated the distance from the shore to the locations of fishing boats related to emergencies in the past six years. The following data are all based on the territorial sea baseline: 7 cases in the port area, 13 cases within the territorial sea baseline, and 19 cases between the territorial sea baseline and the territorial sea line; 47 incidents between territorial sea line- 50 nautical miles beyond the territorial sea baseline, 49 incidents between 50 nautical miles-100 nautical miles beyond the territorial sea baseline, and 8 cases between 100 nautical miles to 200 nautical miles beyond the territorial sea baseline. After statistical analysis, it can be found that most of the fishing boat emergencies occurred in the area between the territorial sea baseline and 100 nautical miles beyond the territorial sea baseline. Due to the long-distance offshore, it will take a long time for rescue forces to reach the scene after a dangerous situation occurs.

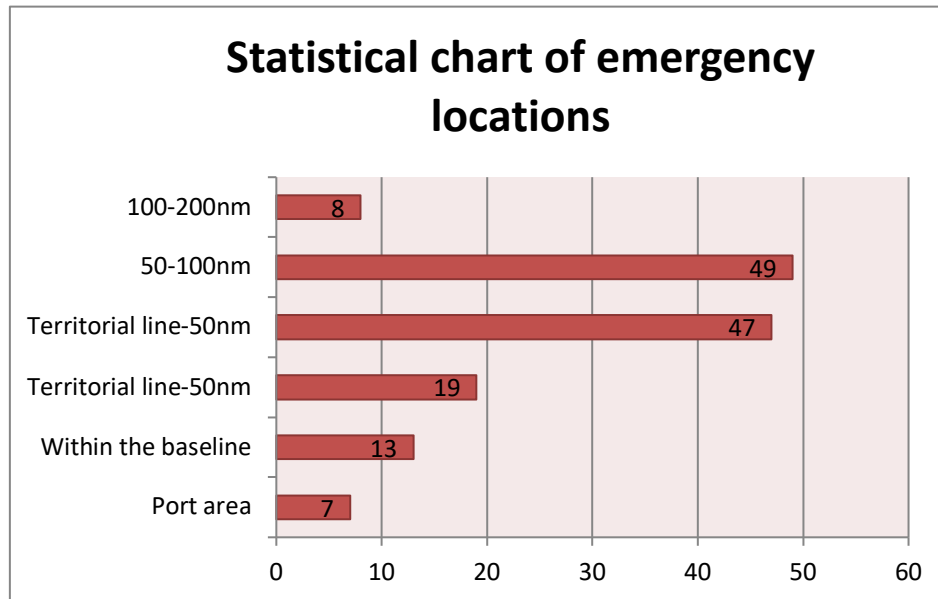


Figure 12-Emergency locations of fishing boats

Source: Created by Author according to data from Qingdao MSA.

2.2.2 Summary of the characteristics of fishing boats related emergencies

Through the above statistics and analysis of fishing boat-related emergencies, we can find that fishing boat-related emergencies have the following characteristics:

- (1) There are so many fishing boats related cases, which account for a large proportion of the SAR work of Qingdao Maritime SAR Center;
- (2) The number of dangerous situations is highly correlated with seasons, and most of them occur in winter;
- (3) The level of a single risk is low, and the distribution of the risk is relatively scattered;
- (4) The locations where the emergencies occur are generally far away from shore.

2.3 Survey on the self-rescue ability and needs of fishermen

In order to improve the SAR success rate of fishing boats, the author investigated and analyzed the first aid ability, injury conditions and first aid needs of the fishing crews. From February 2020 to June 2020, a questionnaire survey of 471 fishermen in various

fishing villages was conducted to analyze the self-rescue ability and needs of fishermen.

2.3.1 Survey object

Fishermen aged 20 to 65 in Qingdao fishery villages were selected according to the registered ports of the fishing boat as the survey object. The number of fishermen surveyed at each registered port is shown in Table 1. A total of 471 questionnaires were conducted in this survey, with 446 valid questionnaires, and the effective response rate was 94.7%.

Table 1- Number of fishermen surveyed in different registered ports

Registered port	Number of registered fishing boats	Number of fishermen surveyed
Dongying	280	28
Huangdao	184	18
Jimiya	1753	175
Luojiaying	682	68
Nvdao	1001	100
Qingdao	22	2
Shazikou	854	80

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

2.3.2 Survey method

According to the statistics of 143 fishing vessel emergencies and the types of injuries and diseases in recent years (see Figure 13 for details), combined with the research purpose of this thesis and the opinions of the fishery authorities, an anonymous questionnaire survey was conducted. The survey content includes demographic characteristics (gender, age, fishing years, education level, etc.), basic first aid conditions (first aid kit, injury occurrence, etc.), first aid knowledge (a total of 13 multiple-choice questions and true or false questions) and first aid training status and

needs (demand, content, form, frequency, etc.). At the beginning, the author planned to use an online app to conduct the questionnaire survey, but during the implementation process, many fishermen had difficulty in operating the mobile app, so, the telephone questionnaire survey was adopted at last.

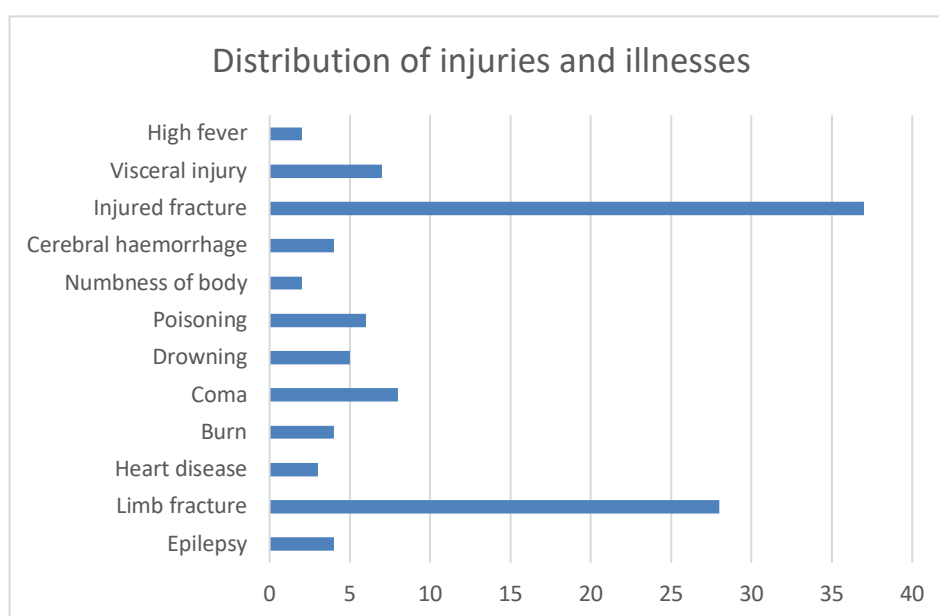


Figure 13-Distribution of injuries and illnesses

Source: Created by Author according to data from Qingdao MSA.

2.3.3 Statistical methods

According to the fishermen's age, education level, type of work, whether they have participated in first aid training, whether they have participated in first aid, the Kruskal-Wallis H test was used to analyze the factors affecting the correct rate of fishermen's first aid knowledge, and the chi-square test was used to analyze the influencing factors of the answer to each question. $P < 0.05$ indicated that the difference is statistically significant.

2.3.4 Survey results

(1) Age distribution

All 446 respondents were male. The average age is (45.1 ± 9.6) years, of which 20-29 years old, 32 people (7.1%), 30-39 years old, 88 people (19.8%), 40-49 years old, 169 people (37.8%), 50-59 Years old, 143 people (32.1%), 60-65 years old, 14 people (3.2%). As shown in Figure 14,

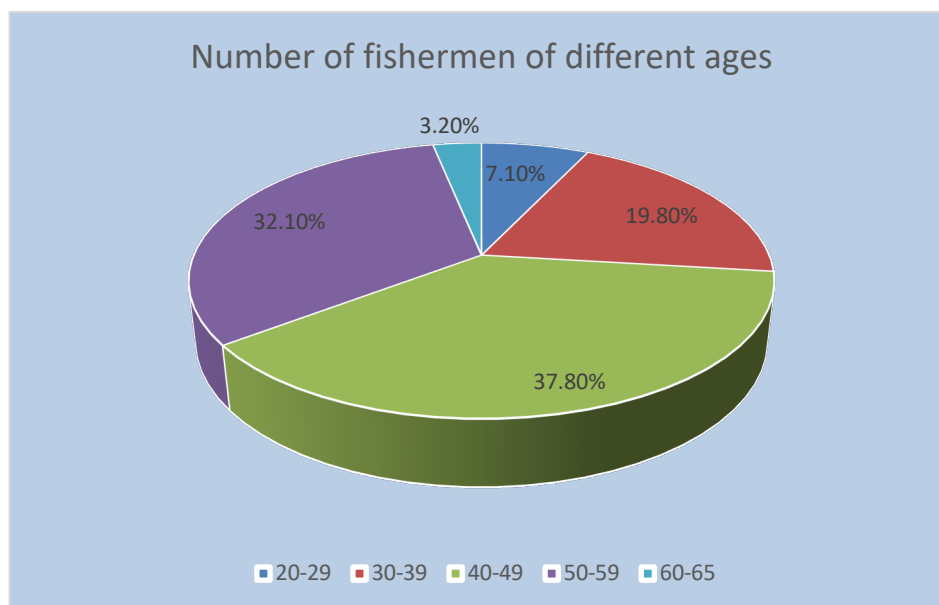


Figure 14-Number of fishermen of different ages
Source: Author.

(2) Injuries of fishermen

As shown in Figure 15, 21.5% of fishermen had suffered from accidental injuries during their work in the past year. The top three accidents were: (1) falls (33.6%); (2) injuries caused by broken ropes (25.2%); (3) blunt injuries (15.9%).

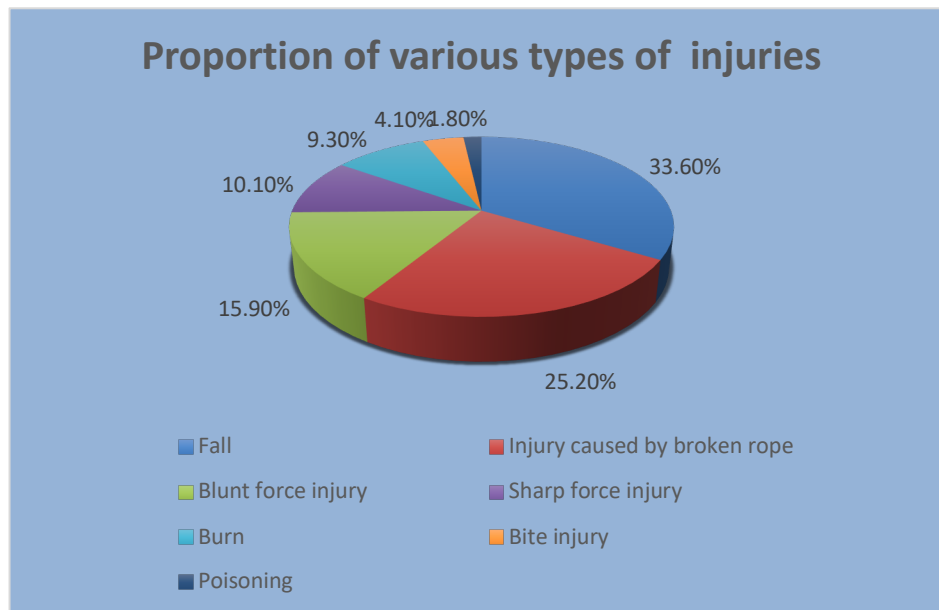


Figure 15- Proportion of various types of injuries

Source: Author.

(3) Other emergency related situations

According to the survey, 56.7% of fishermen do not know the sea rescue telephone number; 15.7% of fishermen have carried out first aid during their work, and the captain has the highest proportion of first aid (38.2%). Other emergency related situations are shown in Table 2.

Table 2- Other emergency related situations

Operation of communication equipment	Totally can't		Simple operation		Skilled	
	124	27. 8%	192	43. 1%	130	29. 1%
First aid kit	None		Equipped but lack of items		Equipped with sufficient items	
	48	10. 7%	375	84. 1%	23	5. 2%
First rescuer	Colleagues onboard		Doctors from shore		Seamen nearby	
	348	78. 1%	83	18. 6%	15	3. 3%

Source: Author.

(4) Survey about fishermen' first aid knowledge

As shown in Table 3, the first aid knowledge level test consists of 7 multiple-choice questions and six judgment questions. There are eight questions with the correct answer rate of less than 50%. Fishermen's first aid knowledge level is generally low.

Table 3- Survey of first aid knowledge of fishermen

First aid questions	Total (N=446)	Whether participated in training			Whether performed first aid		
		Yes (n=275)	No (n=171)	P	Yes (n=70)	No (n=376)	P
Trauma first aid							
Open fractures	176 (39.5%)	111 (40.6%)	65 (37.9%)	0.72	18 (25.9%)	158 (42.1%)	0.14
Severed limb	101 (22.7%)	70 (25.5%)	31 (18.2%)	0.26	5 (7.4%)	96 (25.5%)	0.05
Fracture fixation	106 (23.8%)	57 (20.8%)	49 (28.8%)	0.23	16 (22.2%)	90 (24.1%)	0.95
Fracture with bleeding	96 (21.5%)	52 (18.9%)	44 (25.8%)	0.28	8 (11.1%)	88 (23.4%)	0.17
Bleeding	296 (66.3%)	189 (68.9%)	106 (62.1%)	0.36	49 (70.4%)	246 (65.5%)	0.47
Visceral injury first aid							
Blunt injury	259 (58.1%)	158 (57.5%)	101 (59.1%)	0.84	42(59.3%)	224 (57.9%)	0.71
First aid for poisoning							
Gas poisoning	309 (69.2%)	200 (72.6%)	109 (63.6%)	0.21	47 (66.7%)	262 (69.7%)	0.91
First aid for drowning							
Drowning	236 (52.9%)	143 (51.9%)	93 (54.5%)	0.73	34 (48.1%)	202 (53.8%)	0.74

First aid for burns							
Burn	140 (31.4%)	106 (38.7%)	34 (19.7%)	0.00*	23 (33.3%)	117 (31.0%)	0.68
Other first aid							
Cerebral hemorrhage	192 (43.0%)	109 (39.6%)	78 (48.5%)	0.25	34(48.1%)	158 (42.1%)	0.43
Heart disease	259 (58.1%)	158 (57.5%)	101 (59.1%)	0.84	42(59.3%)	224 (57.9%)	0.71
Epilepsy	218 (48.8%)	140 (52.8%)	73 (42.4%)	0.18	39(55.6%)	179 (47.6%)	0.29
Shock	41 (9.3%)	31 (11.3%)	10 (6.1%)	0.24	5 (7.4%)	36 (9.7%)	0.82

Source: Author.

The Kruskal-Wallis H test was used to analyze the influencing factors of the correct rate of fishermen's first aid knowledge. The results showed that the correct rate of fishermen's first aid knowledge is related to their education level, type of work, whether they have participated in first aid training, and whether they have performed first aid. As shown in Table 4, the higher the level of education, the fishermen who have participated in first aid training and performed first aid are more likely to get a higher rate of answering questions, indicating that learning and training play an important role in improving fishermen's first aid knowledge and self-rescue ability.

Table 4-Analysis of influencing factors of correct rate

Factors	Number of fishermen surveyed	Correct rate (%)	H	P
Age				
20-29	23	54.6	8.43	0.07
30-39	91	56.5		
40-49	172	55.7		

50-59	146	50.2		
60-65	14	47.5		
Education level				
Elementary school and below	123	50.0	19.94	0.00*
junior school	267	53.0		
High school and above	44	65.6		
Type of work				
Captain	135	59.1	10.29	0.03*
Chief Engineer	93	50.1		
sailor	101	52.7		
Others	18	48.6		
Whether participated in training				
Yes	171	56.2	7.68	0.00*
No	275	49.4		
Whether participated in first aid				
Yes	70	58.9	4.20	0.04*
No	376	52.9		
Note: * indicates statistical significance when below 0.05.				

Source: Author

(4) Current status of first aid training

According to the survey, 61.6% of fishermen have participated in first aid training, of which 53.5% of fishermen have only participated in one training, mainly for obtaining crew certificates. In terms of training needs, 58.7% of fishermen are willing to participate in first aid knowledge training, and 33.7% of fishermen are indifferent. 39.0% of fishermen are willing to pay to participate in more targeted first aid training.

(5) Summary of the survey

Through the questionnaire survey, it can be found that the current level of knowledge

of fishermen is generally low, which is an important factor affecting the self-saving ability of fishermen. At the same time, through the questionnaire survey, it can be found that fishermen who have received first aid training or participated in pre-hospital first aid have a significantly better understanding of first aid knowledge than fishermen who have not, indicating that first aid training plays an important role in improving fishermen's self-rescue ability, And the questionnaire survey also clarified the fishermen's emergency training needs, laying the foundation for effective emergency training.

CHAPTER 3 Shortcomings of fishing boats related SAR in Qingdao

The maritime SAR of fishing boats aims to save the life and property of fishermen in distress. As the last link in the maritime security chain, it is the most direct means to reduce or even avoid the harm of sudden emergencies at sea. However, China's current maritime rescue mechanism generally shows a trend of simplification, over-emphasizing the role of professional rescue forces and official power, while ignoring the exertion of other public forces and self-rescue and mutual rescue capabilities of fishing boats. In addition, problems such as the limitation of national rescue resources and the limitation of rescue scope have seriously affected the development of rescue operations for fishing boats operating at sea.

Although the actual rescue effect of social forces (including fishing boats) is more significant, its importance has not received due attention, and its status in maritime rescue has been far lower than the professional rescue forces. At this stage, the different subjects of China's maritime SAR organization generally lack effective organizational guidance. The cooperation among the government, society and fishermen is still in the exploratory stage. An effective model system has not yet been formed, and the cooperation effectiveness of multiple subjects has not yet been fully utilized. The government-led maritime rescue mechanism still plays a key role in ensuring maritime safety. However, we have to admit that the inadequacy of China's current maritime rescue mechanism has severely restricted the timely progress of the rescue work and caused great losses to the people and property. The dilemma is mainly manifested in the following aspects.

3.1 Insufficient construction of the SAR mechanism

3.1.1 Administrative system

(1) Although in the "Qingdao Maritime SAR Contingency Plan", Qingdao Municipal Government has established the Maritime SAR center as the command organization and clarified the responsibilities of each SAR member unit, but only when dealing with serious and above level emergencies, they will be reported to the chief commander of the SAR center. The SAR center office will directly conduct command and coordination when dealing with emergencies at the "general" level or below. At this stage, due to the structure of the administrative system and other reasons, the relationship between different departments and different levels within the government has not been straightened out, making the maritime SAR coordination work far from meeting the needs of actual work.

On the one hand, due to historical and institutional reasons, local governments have not paid enough attention to maritime SAR work. At present, Qingdao Municipal People's Government has not set up a special agency to be responsible for maritime SAR duty and emergency response. The relevant work is undertaken by the VTS of Qingdao Maritime Safety Administration. This has also led some departments to suppose that the maritime SAR work is the responsibility of the Qingdao MSA. Although the municipal government has given Qingdao MSA the functions of maritime SAR, it has not given relevant power yet. The composition of the member units of the Qingdao Maritime SAR Center is complicated. The member units are in a mutually parallel and non-subordinate structure in the administrative system. They work under the leadership of their respective superior departments and lack unified command and leadership in the actual maritime SAR work. This has caused local people's governments at various levels and related member units to generally regard maritime SAR work as the job responsibilities of one or several departments, so they

cannot pay enough attention to maritime SAR work.

On the other hand, due to administrative system reasons, the maritime SAR command coordination mechanism is not operating smoothly. As an important part of national emergency management activities, all member units of maritime SAR need to coordinate and cooperate while performing their duties. However, each unit is under a different system, and the maritime SAR centers do not have command authority over it, resulting in various difficulties in force deployment; At the same time, some units have relatively independent management systems, and the procedures and standards for force mobilization are more complicated. In actual work, before dispatching forces, it may be necessary to report level by level for instructions, delaying the timing of rescue; In addition, due to the consideration of the distribution of benefits, it is difficult for each member unit to form a working interface that shares power and responsibilities. Under certain special circumstances, it may even be based on the interests of the department to take actions based on the wishes of the unit, thereby affecting the orderly, scientific and efficient development of maritime SAR management.

(2) A single SAR member unit or a single maritime SAR force is often unable to meet the requirements of the rescue of fishing boats in dangerous situations. Therefore, it is necessary to strengthen communication and cooperation between SAR member units and to communicate and optimize the emergency response process for different fishing boats related risks. However, there is a lack of effective communication between SAR member units. There will be a small amount of information exchange in the early stage of a rescue operation, however, usually, there is no communication in the later stage and after the end of the emergency.

(3) At present, the member units of the maritime SAR center cannot share SAR resource information in real-time. The information of merchant ships is controlled by the maritime department, the information of military ships is controlled by the military department, and the information on fishing boats is controlled by the Bureau of Ocean Development. The information has not been effectively integrated, and real-time information sharing cannot be achieved. Therefore, SAR centers cannot effectively use maritime SAR resources to achieve efficient and rapid rescue by far.

3.1.2 Lack of effective cooperation mechanism in different municipal SAR areas

At present, there is an urgent need to strengthen regional maritime SAR cooperation. When reading and analyzing the SAR records of the cases, the author found that although many fishing boat emergencies occurred in Qingdao maritime SAR jurisdiction, they were closer to neighboring cities, and the neighboring city's maritime SAR center was the first one to receive the emergency report.

On March 30, 2015, Qingdao Maritime SAR Center received a distress call transferred from Shandong Maritime SAR Center. The fishing boat "Liaohuyu 31580" called Weihai Maritime SAR Center for help due to a sudden heart attack of a fisherman. The position was 35°52'N/123°32'E. When the Weihai Maritime SAR Center verified the location of the emergency, it was found that the location was within the Qingdao Maritime SAR Responsibility Zone, so they had to report to Shandong Maritime SAR Center and transfer the emergency to Qingdao Maritime SAR Center instead of launching rescue immediately. In fact, this fishing boat was closer to Weihai Shidao and was sailing towards Shidao at a speed of 8-9kn (Figure 16). Qingdao Maritime SAR Center immediately organized rescue after receiving the call and contacted the Beihai Rescue Bureau to send a professional rescue force for rescue. As the fishing boat was closer to Shidao, the Beihai Rescue Bureau sent the "Beihai Rescue 201" on

duty near Shidao. When coordinating the doctors to participate in the operation, Qingdao Maritime SAR Center had to contact Weihai Maritime SAR Center to coordinate the doctors from Shidao. In the entire rescue process, a lot of time was wasted due to the problems related to the jurisdiction. Different centers lack direct and effective communication. Therefore, it is necessary to establish a clear and effective cooperation mechanism between SAR centers in neighboring cities.

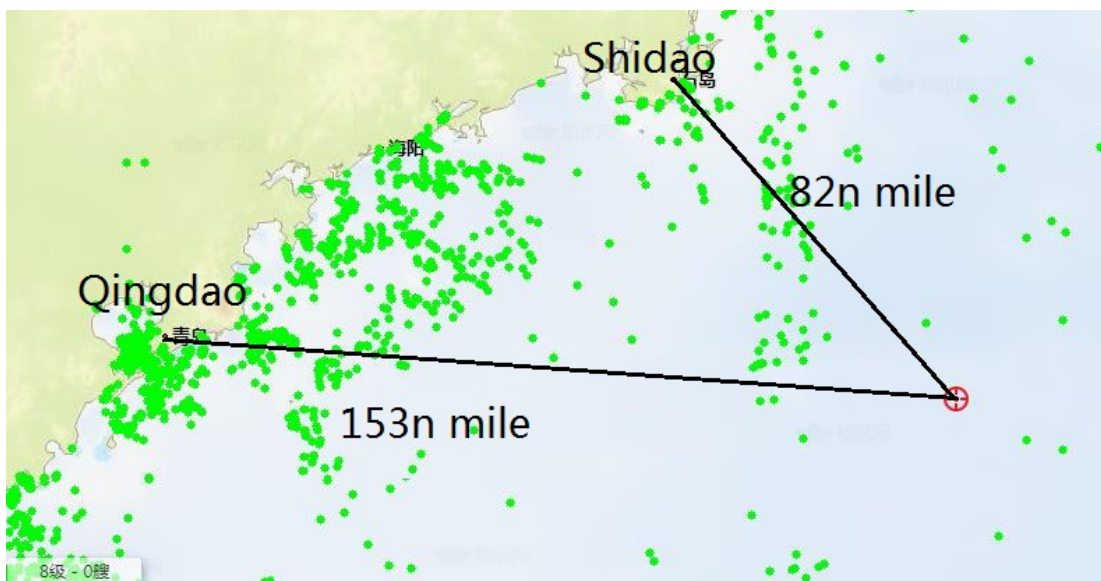


Figure 16-The distance between the emergency point and the two cities
Source: Author.

3.1.3 Imperfect warning mechanism

(1) Qingdao Maritime SAR Center Office has signed a cooperation agreement with the Qingdao Meteorological Bureau. The Maritime SAR Center can obtain the meteorological information shared by the Meteorological Bureau as soon as possible, which provides convenience for the center to quickly release warning information. However, the center has not yet signed a relevant cooperation agreement with the Bureau of Oceanography. As a result, relevant maritime early warning information can only be communicated through the higher-level SAR center. Therefore, the timeliness

of maritime early warning information cannot be guaranteed. In addition, the means of issuing early warning information are limited, and it is only released to relevant SAR member units in the jurisdiction through the Internet and SMS, and the feedback of implementation by each SAR member unit cannot be received timely.

(2) Currently there are 4,776 registered fishing boats in Qingdao, which are generally small in size and simple in facilities. There are about 1,300 fishing boats with the main engine power of more than 60 horsepower (of which 800 are more than 150 horsepower). About 1,300 fishing boats are equipped with Beidou satellite positioning communication terminals, and about 1,500 fishing boats are equipped with AIS terminals. On the whole, the communication equipment of fishing boats is backward, and the equipment for receiving early warning information is scarce. Most fishing boats do not have special equipment for receiving early warning information, and the ability to receive information through mobile phones is limited. In places far from the shore, mobile phones have no signal and they can only rely on the fishermen's maritime experience to predict weather conditions.

3.2 Deployment of professional rescue forces

(1) The professional rescue assistance in Qingdao waters is provided by the Beihai Rescue Bureau. The BRB has a total of 17 maritime professional rescue boats, three S76+ maritime rescue helicopters and one EC225 maritime rescue helicopter. Rescue helicopters are deployed at Dalian Zhoushuizi Airport and Yantai Penglai Airport, are responsible for emergency rescue duty at sea within 110 nautical miles under simple weather conditions during the day. These professional rescue forces need to be responsible for rescue missions in the waters of 260,000 square kilometers north of Lianyungang and the Heilongjiang trunk line, which are seriously insufficient.

SAR forces, the rescue of fishing boats in Qingdao maritime SAR jurisdiction is far from satisfying only by relying on professional and official rescue forces. Other fishing boats, merchant ships, and public rescue forces near the locations of emergencies can effectively make up for the shortcomings of professional and official rescue forces because they can carry out an immediate rescue to the fishing boats in distress before the professional rescue forces reach the location where the emergencies occur. The participation of public forces can significantly improve the rescue success rate of fishing boats in distress and reduce the risk of further deterioration. However, due to insufficient government support and many other reasons, the enthusiasm and potential of Qingdao's maritime public forces have not been fully stimulated.

(1) There is only one maritime rescue volunteer team in Qingdao called Red Cross Maritime Rescue Team. Due to the lack of SAR equipment and personnel capabilities, they can only deal with the emergencies in the port area, and the scope of rescue is very limited. The vast majority of fishing boats related emergencies still totally rely on professional rescue forces, fishery administration and other official rescue forces.

(2) As a public product supply, maritime rescue consumes huge human, material and financial resources. When the government-based professional rescue assistance cannot fully meet the rescue needs, we have to rely on the participation of public assistance. In article 10, International Convention on Salvage (1989) requires *“Every master is bound, so far as he can do so without serious danger to his vessel and persons thereon, to render assistance to any person in danger of being lost at sea”*; In article 16, the convention states that *“a slavor of human life is entitled to a fair of the payment”*. UNCLOS also requires in Article 98 *“to render assistance to any person found at sea in danger of being lost”*. However, due to the unclear provisions of the Convention, if there is no effective rescue of any property, the life-saving person will not get any

remuneration even if he has paid a lot of costs (Yuan, 2020). In the actual rescue operations, none of the rescue boats received payment from the rescued fishing boats. The ships and personnel involved in the rescue operations need to bear the indirect economic losses and the direct increase in fuel consumption caused by the impact of the rescue on normal operations. In some difficult situations, the rescuers themselves have to bear the risk of casualties in rescue operations. At this stage, the volunteer ships participating in the SAR cannot get rewards sufficient to make up for the losses. At the end of each year, Shandong Provincial Maritime SAR Center will reward public forces for participating in rescue operations at sea. The rewards are mainly honoring, sometimes in cash, but each ship can only receive a few thousand to tens of thousands of yuan which is far from enough.

3.4 Shortcomings of the fishing boats

There are many factors that affect the safety of fishing boats and the success rate of rescue in dangerous situations. In addition to the maritime SAR system and capabilities, there are also the fishing vessel management system and the fishermen themselves. On 29 September 2012, the STCW-F Convention, which is the first to establish basic requirements on training, certification and watchkeeping for Fishing Vessel Personnel on an international level, entered into force (IMO). However, China is not a contracting state by far and this convention is only for crews of seagoing fishing vessels of 24 meters in length and above (IMO). In China, a large number of fishing boats are less than 24 meters in length. Since April 20, 2018, the responsibilities of fishing vessel inspection and management had been transferred from the Ministry of Agriculture and Rural Affairs to the Ministry of Transport to further improve the requirements of the ship inspection and management system. However, due to the relatively weak foundation and the difficulty of monitoring, many problems still exist. Through the questionnaire survey of fishing boats in Qingdao's jurisdiction, it can be found that

fishing boats normally have poor life-saving equipment; Fishermen's generally low education level, and lack of knowledge about emergency first aid, also led to poor self-rescue and mutual rescue capabilities.

(1) Poor life-saving equipment

Many fishing boats in Qingdao's jurisdiction are in poor condition, even some of them have outlived the usefulness. However, because too many fishermen's economic situation is poor and they are unable to purchase new boats, many old fishing boats are still fishing at sea, which greatly increases the incidence of emergencies. Due to the difficulty of supervision caused by the operating characteristics of fishing boats, many of them are not equipped with fire extinguishers, life rafts, life jackets, and lifebuoys. Once a fishing boat is in danger, due to the lack of life-saving equipment, it cannot start self-rescue in the first time, thus losing the best rescue opportunity. The water temperature in Qingdao waters is particularly low in winter, which greatly shortens the survival time of people falling into the water. At this time, the self-rescue ability of fishing boats is particularly important.

(2) Poor communication ability

At present, many fishing boats still use mobile phones as communication equipment on board, but the signals of mobile phones at sea are very poor, often only within a range of more than ten nautical miles near the shore. Once the fishing boat is in danger, it will not be able to report the emergency in time due to lack of signal; In addition to mobile phones, some fishing boats also be equipped with SSB. However, the communication frequency used by the fishing boats is different from that of the SAR center. When a fishing boat is in distress, it cannot directly report to the SAR center through SSB but can only be transferred by the owner. Therefore, the SAR center is not able to directly grasp the dangerous situation of fishing boats and fishermen, as

well as the weather and sea conditions at the location of the emergency. All information needs to be relayed by the shipowner, which will seriously delay the rescue time and increase the difficulty of SAR operation. In addition, many fishermen can only speak the dialect of their hometown due to the low level of education. In SAR operations, the author encountered many communication difficulties caused by this.

(3) Poor life-saving skills

Unlike merchant crewmembers, there is currently no mature training and examination system for fishermen. Due to the development of the fishery economy, many farmers from the inland provinces go to work on fishing boats, and many of them do not have safety knowledge training from the fishery authorities before they go to work. They seriously lack in offshore operation experience and safety awareness, resulting in frequent accidents of fishermen during offshore operations; And because most of the fishing crews have not received systematic medical training, as well as lack of necessary medical knowledge and medical equipment, they cannot deal with some injuries correctly at the early stage.

(4) Poor safety consciousness

There is no strict watchkeeping regulation on fishing boats. The fishing operation is very hard and requires a lot of physical energy. During non-fishing operation hours, usually, all crew members will rest at the same time, and the personnel on duty cannot be guaranteed at the bridge, which will seriously increase the risk of collision with merchant ships. On July 11, 2014, "Luruyu 37609" collided with a merchant ship in the middle of the Yellow Sea, causing serious consequences of 7 people missing. In the ensuing investigation, according to the rescued crew members, when the accident happened, everyone was resting, and no one was on duty at the bridge.

CHAPTER 4 Suggestions for improving SAR ability related to fishing boats

4.1 Systems of maritime SAR in developed countries

4.1.1 SAR management system in America

The SAR system of the United States has two levels, namely the National SAR Committee (NSARC) and the United States Coast Guard (USCG). The NSARC is responsible for leading the United States' maritime SAR work and formulating the national SAR policy and coordinating the SAR affairs of the states. It is composed of the Ministry of Defense, the Ministry of Commerce, and the Ministry of Transportation etc. The USCG is responsible for the specific implementation of maritime SAR policies and maritime safety supervision. Its main functions are to perform the international conventions that the United States has joined and to be responsible for maritime safety supervision and maritime SAR, as well as implementing relevant SAR policies formulated by the NSARC (Guo, 2014).

The United States has implemented sub-regional SAR emergency jurisdiction, dividing the country's waters into three parts: internal waters, offshore and open seas. The internal waters (i.e. the inland rivers and the Great Lakes region) are handled by the air rescue team of the Air Force; The coastal areas are handled by the Coast Guard; The open seas are under the command and management of the foreign commander of the Ministry of National Defense. The entire SAR area is divided into jurisdictions. When a large-scale maritime accident occurs, the rescue coordination center of each jurisdiction will be responsible for coordinating the actions of ships and aircraft.

At present, the USCG has a powerful communication system and a complete management system as well as strong technical equipment. Therefore, the United States has formulated a relatively high emergency response standard: the efficiency

rate of professional rescue is 93%, and the efficiency rate of national rescue is 99%. The USCG has clear requirements for emergency response time: the SAR response plan must be formulated within five minutes after receiving the distress information, and the decision to start the SAR operation must be made within fifteen minutes after the plan is formulated; The time consuming to arrive at the distress scene should be within 1.5 hours after the plan is made.

Although the United States has the most powerful professional SAR capabilities in the world, it still attaches great importance to the role of maritime SAR volunteer organizations and provides vigorous support for the construction and development of public forces. At present, there are tens of thousands of volunteers in the United States participating in auxiliary work for maritime SAR. They come from all walks of life, industries and fields, and most of them are enthusiasts of navigation, boats, and radio stations. The US government provides volunteers and their organizations with free skills training, rewards and fuel subsidies for their participation in maritime SAR operations to make up for their economic losses. In addition, in order to improve volunteers' maritime SAR skills, the United States and Canada hold a maritime SAR competition for volunteers every year.

4.1.2 SAR management system in the UK

The Department for Transport (DFT) is the competent government agency for maritime SAR. The UK SAR Strategic Committee is responsible for assessing the adequacy of the UK's SAR response, co-ordination and resources and is currently chaired by the DFT. The tasking of adequate resources to respond to civil aeronautical and maritime SAR, and the co-ordination of that response, is the responsibility of the Maritime and Coastguard Agency (MCA) through HM Coastguard (Strategic Overview of SAR in the UK, 2017). The MRCCs are set up under the MCA. The local

SAR coordination centers are responsible for the command and coordination of maritime SAR and pollution prevention. Maritime SAR operations are specifically organized and implemented by various SAR units. There are six maritime rescue coordination centers (RCC) and 18 maritime rescue sub-centers (RSC).

The UK's maritime SAR force consists of civil organizations and government departments. The government force is mainly composed of the army, the MCA and the police department. The civil force is mainly composed of the Royal National Lifeboat Institution (RNLI), the Royal Life Saving Society UK (RLSS UK), civilian helicopters and civilian volunteers. Compared with other western countries, the MCA has very few personnel, with only a few hundred staff engaged in maritime SAR. However, there are a large number of civil organizations and volunteer SAR teams, as well as 10,000 volunteers involved in maritime SAR. Therefore, most of the maritime SAR work is done by the public forces. The United Kingdom attaches great importance to the training of maritime SAR personnel. In addition to regular training for government SAR personnel, volunteers are also trained by the Coast Guard or the RLSS with a higher degree of professionalism. After the training is qualified, assessments are also carried out to ensure that they continue to improve their emergency response capabilities for maritime SAR.

There are many government agencies and social organizations involved in maritime SAR in the UK, but they have clear positioning, clear division of labor, and tacit cooperation in maritime SAR. When an emergency at sea occurs, all agencies, organizations, and personnel can obey commands and cooperate with each other in the process of participating in SAR operations and carry out their work in accordance with established procedures. They usually also pay attention to strengthening communication, and through regular meetings to exchange information, deepen

understanding and increase consensus.

4.1.3 SAR management system in Japan

Japan has established a maritime SAR network with the Coast Guard as the center and covering the entire Japanese waters. The maritime SAR network divides the waters under Japanese jurisdiction into 11 areas, each with a maritime security department.

The Japan Coast Guard divides the area under its jurisdiction into far seas, middle seas, offshore seas and port area, and arranges corresponding personnel, boats, and aircraft to conduct round-the-clock patrols (Wang, 2008). Once a ship is found in distress, the SAR force can quickly arrive at the scene and conduct maritime SAR operations in a timely and effective manner.

Japan's maritime SAR work also attaches great importance to civilian forces, which is also one of the main characteristics of Japan's maritime SAR management system. The coastal people spontaneously organized the Japanese Flood Relief Society earlier, headquartered in Tokyo, with branches in coastal counties. The Japan Flood Relief Society is strong, with hundreds of small SAR boats and nearly 10,000 volunteers. The Japan Coast Guard regards the Japan Flood Relief Society as an important part of the maritime SAR management system.

4.1.4 Suggestions derived from SAR systems in developed countries

Due to the differences in the basic political systems, cultural traditions, and economic development levels of various countries, there are also obvious differences in the maritime SAR management systems. However, although there are differences in the organization, operation mechanism, and rule system, we can still find the commonality in the analysis of the above three national SAR systems, namely: it is necessary to

improve the rapidity and effectiveness of SAR operations through the establishment of organizational systems and take various measures to promote public forces to participate in maritime SAR operations. These are very positive references for the improvement of China's maritime SAR management system. Based on the analysis of the deficiencies in Qingdao's maritime SAR in Chapter 3, the following suggestions are proposed by the author for the improvement of the SAR system and the promotion of public participation:

1. Strengthen the improvement of SAR system

(1) "Qingdao Maritime SAR Contingency Plan" needs to be revised in time to further clarify the responsibilities of each unit after the organizational adjustment. Each SAR member unit must formulate and improve its work plan based on its own responsibilities. All coastal districts (cities) should set up special departments to be responsible for maritime SAR operations and accept the leadership of Qingdao Maritime SAR Center to ensure that the instructions from the center can be quickly implemented.

(2) Qingdao Maritime SAR Center shall regularly organize and convene SAR working conferences and liaison staff meetings to study and solve new problems found in the recent SAR operations in a timely manner, so as to continuously improve the maritime SAR emergency response capabilities; It is necessary to improve the emergency consultation and expert consultation system, and organize experts from maritime, ocean, fishery and other units to set up expert groups in the occurrence of serious sea emergencies to jointly formulate the emergency treatment plan; The SAR center shall regularly organize and carry out maritime SAR emergency drills, continuously straighten out the SAR mechanism, and check the scientificity, rationality and operability of it.

(3) The Qingdao Municipal Government should introduce a SAR accountability mechanism. In the maritime SAR operations, the staff who do not participate in the maritime SAR operation without proper reason after receiving the instruction, fail to participate in the maritime SAR operation in time, disobey the command, or quit the SAR operation without consent, shall be punished according to the mechanism.

2. Increase the participation of public forces

(1) It is necessary to improve the SAR compensation and reward mechanism and give material and spiritual rewards to organizations, ships or individuals that actively participate in SAR operations. Compensation is needed for fuel and other substances consumed by ships participating in maritime SAR, so as to increase the enthusiasm of public forces to participate in maritime SAR. Rewards can be economical, material and spiritual or a combination of them, other ways such as tax incentives, fuel subsidies also work.

The reward ratio and scope of rewards should be appropriately increased. At the same time, the publicity of the reward mechanism and the disclosure of rewards should be done, and this work should be carried out continuously and regularly to avoid the public's skepticism about the stability of the mechanism.

(2) It is also necessary to change the situation that the existing social forces are limited to individual enterprises, public boats and individuals, and to encourage more port and shipping enterprises, social groups, non-profit organizations to participate in maritime SAR; The government needs to use policies and financial support to cultivate some enterprises related to maritime SAR operations, and it is important to ensure that they

have sufficient capacity to undertake maritime SAR tasks. The maritime SAR capabilities of the objects to be cultivated should be comprehensively evaluated, and the public forces with better conditions should be selected for key support.

4.2 Strengthen the allocation and optimization of professional rescue forces

4.2.1 Optimize allocation area

As shown in Figure 18, the author conducted a statistical analysis of 143 fishing vessel emergencies that occurred from 2014 to 2019 and marked the locations of them. In the figure, it can be seen that fishing boat emergencies mainly occurred in three areas, and most of them occurred far away from the standby point of the professional force. Once a dangerous situation occurs, it is difficult for the professional force to rescue in the first time. In order to shorten the time for the professional rescue force to reach the scene as much as possible, it is necessary to reasonably optimize the allocation area of professional rescue forces.

As currently there is only one professional rescue ship on standby in Qingdao's jurisdiction, it is recommended to change the current internal anchorage standby point to the Chaolian Island anchorage (emergency standby point) through comprehensively considering the limitation on the number of professional rescue forces, the cost of supplying at the allocation point, and the distance from the dangerous areas, so that 3-4 hours can be saved when performing rescue tasks, which will greatly increase the success rate of SAR operations.

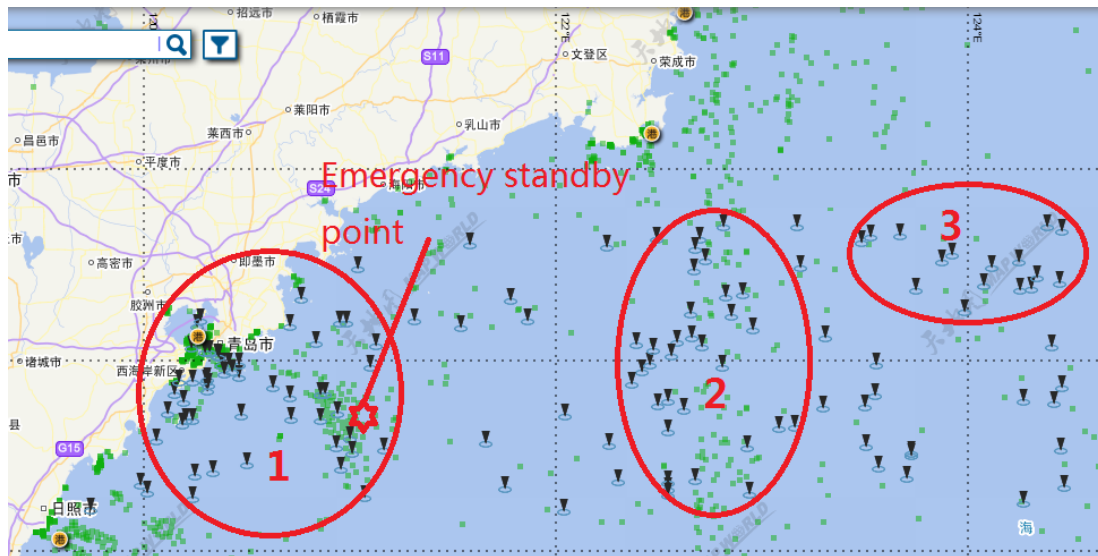


Figure 18-A more ideal standby point for the professional rescue ship

Source: Author.

4.2.2 Full use of existing SAR equipment

Rescue helicopters are currently the most effective and fastest way to carry out rescue operations at sea. However, helicopters participating in the rescue in Qingdao jurisdiction need to take off from Penglai, and there is no other city can provide refueling services. This results in that the rescue helicopter's maximum rescue distance is only 110 nautical miles. Most of the range in Qingdao jurisdiction is beyond this distance. The cost of rescue helicopters and their additional airports and maintenance costs is huge, so it is unrealistic to build a new helicopter base. It is possible to explore the way that the government purchases services, incorporate Qingdao civilian helicopters into the maritime SAR system, and the government will pay for the expenses and provide professional training; In addition, SAR center should strengthen cooperation with the navy to promote the sharing of military helicopter base resources to meet the needs of rescue helicopters on standby in Qingdao or fuel supply, which will greatly increase the SAR distance of rescue helicopters.

4.3 Improve the self-rescue ability of fishing boats

Improving the self-rescue ability of fishing boats is the fastest and most effective way to increase the success rate of fishing boat rescues, and it will also be much more economical compared to the construction of professional rescue bases. According to the questionnaire survey in Chapter 2, when fishermen are injured or sick at sea, the proportion of the first rescuer being a colleague is as high as 78.1%, and the proportion of ships equipped with adequate first aid kits is only 5.2%. In addition, the fishermen's first aid knowledge is generally insufficient; Only 29.1% of fishermen on fishing boats can use distress communication equipment proficiently, and many fishing boats are not equipped with long-distance communication equipment. To give full play to the self-rescue ability of fishing boats, on the one hand, it is necessary to improve the hardware facilities of fishing boats; on the other hand, it is important to improve the self-rescue awareness and skills of fishermen. Relevant law enforcement agencies need to improve the inspection mechanism for the equipment of fishing boats with first aid. During the fishing moratorium, the government should provide subsidies and carry out targeted training on maritime safety and first aid knowledge to enhance fishermen's ability to rescue themselves.

4.3.1 Strengthen the inspection of first aid items on fishing boats

As China's fishery resources continue to decrease, the income of fishermen is also declining, which makes boat owners more reluctant to invest in maintaining fishing boats. When in distress at sea, fishing boats often fail to send distress reports, and there are often cases in which the injured and sick fishermen cannot receive effective treatment due to the lack of necessary first aid supplies. Therefore, the fishing vessel inspection system must be improved, and the inspection of communication and life-saving equipment must be strengthened before the fishing boats go to sea.

4.3.2 Strengthen first aid skills training

According to the questionnaire survey, fishermen are generally willing to receive first aid knowledge training. The government should organize training courses and provide subsidies during the fishing moratorium and ask professional first-aid personnel to provide guidance; It is also possible to explore a market-oriented path, that is, after obtaining professional first aid certificates, fishermen can get higher remuneration in the market. In this way, every licensed fisherman can help too many fishing boats in the same area.

4.4 Establishment of the mutual rescue system for fishing boats

SAR at sea should follow the nearby principal. The fishing boats themselves have great advantages in maritime SAR, such as the low freeboard that can facilitate the transfer of the wounded. According to the characteristics of fishing boats emergencies, it can be found that carrying out mass mutual rescue is the most timely, effective and economical rescue method. It is difficult for professional and official rescue forces to timely deal with the emergencies of fishing boats far away from the land. However, compared with the professional rescue forces, the mutual rescue capabilities of fishing boats and fishermen are insufficient, and the organization of mutual rescue system is loose, therefore, studying and constructing countermeasures and mechanisms for the mutual rescue of fishing boats at sea is of great importance and significance in saving maritime fishing accident losses and ensuring the safety of fishery.

4.4.1 Principles of constructing mutual rescue mechanism for fishing boats

(1) The principle of full coverage of the mutual rescue

The allocation and supply of China's maritime rescue professional forces and resources are very different in space and region, and the differences in rescue resources for different groups are also obvious. Fishing boats are a vulnerable group in maritime

rescue, and the supply of rescue services is far below their rescue needs. The problem of rescue coverage has become a major problem in China's maritime rescue. In order to meet the rescue needs of maritime fishing boats to the greatest extent, the requirement of full coverage of mutual rescue should be met when establishing a mutual rescue mechanism for fishing boats.

(2) Neighborhood mutual rescue system

Scott (1976) pointed out in his book 《The Moral Economy of the Peasant》 that: "Under the survival ethics of 'safety first', what farmers pursue is not to maximize income, but to lower risk distribution and higher survival security." "If they need for minimum security is a powerful motivator in farmers' lives, then people can find institutionalized patterns in farmers' communities that meet this need." "In fact, in villages where the survival ethics of 'safety first' has a social expression, this motivation is of paramount importance in the social control and reciprocity that shape people's daily behavior."

While protecting the fishermen's fishery life, it also implements the social security principle of risk-sharing. This is what Scott called "assistance mechanism". For a long time, fishermen have gradually formed some mutual rescue experience after long-term interaction; that is, an informal fishermen mutual rescue guarantee system to reduce the harm caused by maritime risks. The emergencies of fishing boats can greatly endanger life and property safety. Life safety involves the most basic and minimum survival ethical needs of people. As one of the mainstays of farmers, fishermen cannot be ignored. Scott's neighborhood mutual rescue system based on the principles of "safety first" and "risk avoidance" is also applicable to fishermen under high-risk threats.

(3) Establishment of fishing areas

When a fishing boat is in danger, in order to effectively and quickly carry out the mutual rescue operation, it is necessary to clarify the area where the fishing boat is

located and the dynamics of nearby fishing boats. In order to effectively grasp the dynamics of fishing boats, when constructing the mutual assistance system, relying on the division of fishing areas, the Qingdao maritime SAR area is gridded, and rescue teams are organized and divided according to grid areas.

(4) The principle of matching big and small fishing boats

Considering the size and sailing ability of fishing boats, in order to give full play to the role of each fishing boat in the mutual rescue mechanism, the process of constructing the mutual rescue mechanism for fishing boats shall be carried out in accordance with the principle of "steel boats match wooden boats, and big boats match small boats".

4.4.2 Construction of mutual rescue mechanism for fishing boats

(1) Establish mutual rescue communities for fishing boats

At present, Qingdao has a total of 4,776 registered fishing boats distributed in coastal cities and towns. According to statistics, there are seven registered ports for fishing boats, namely, Dongying, Huangdao, Jimiya, Luojiaying, Nudao, Shazikou and Qingdao. The number of fishing boats from different registered ports is shown in Table 5.

Table 5- Number of fishing boats in each registered port

Registered port	Number of fishing boats	Area
Dongying	280	Jiaozhou
Huangdao	184	West Coast New Area
Jimiya	1753	West Coast New Area
Luojiaying	682	Jimo
Nvdao	1001	Chengyang
Qingdao	22	Shinan
Shazikou	854	Laoshan

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

According to the principle of mutual assistance among neighbors, the fishing boats in Qingdao are divided according to their registered ports. Considered that there are only 22 fishing boats registered in Qingdao, they are assigned to Shazikou according to the principle of proximity, thus forming six mutual rescue communities, and then each community is numbered, as shown in Table 6.

Table 6-The establishment of mutual rescue communities

Mutual rescue communities	Community ID	Number of fishing boats
Dongying	YJA	280
Huangdao	YJB	184
Jimiya	YJC	1753
Luojiaying	YJD	682
Nvdao	YJE	1001
Shazikou	YJF	876

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

(2) Establishment of rescue teams in communities

As shown in Table 7, in accordance with the principle of "big boats match small boats", the author made statistics on the size of all fishing boats based on the registered ports, in order to establish a more detailed structure based on the full consideration of the rescue performance of fishing boats, so that the rescue team can give full play to the function and role of fishing boats in mutual rescue.

Table 7-Size statistics of fishing boats in mutual rescue communities

Mutual rescue communities	Length(m)	Number
Dongying	0-10	7
	10-20	25
	20-30	202
	30-40	46
	40-50	0
Huangdao	0-10	175
	10-20	6

	20-30	3
	30-40	0
	40-50	0
Jimiya	0-10	937
	10-20	611
	20-30	188
	30-40	7
	40-50	10
Luojiaying	0-10	142
	10-20	337
	20-30	175
	30-40	28
	40-50	0
Nvdao	0-10	873
	10-20	107
	20-30	21
	30-40	0
	40-50	0
Shazikou	0-10	685
	10-20	92
	20-30	75
	30-40	18
	40-50	6

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

Finally, through comprehensive consideration of the size and registered ports of the fishing boats, four mutual rescue teams were established in Dongying community, three mutual rescue teams in Huangdao community, ten mutual rescue teams in Jimiya community, nine mutual rescue teams were established in Luojiaying community, and ten mutual rescue teams were established in Nvdao and Shazikou communities respectively. The group numbers and the number and size of the fishing boats are shown in Tables 8-13.

Table 8-Dongying fishing boat mutual rescue team

Mutual rescue communities	Mutual Rescue Team	Length(m)					Total
		0-10	10-20	20-30	30-40	40-50	
Dongying	YJA01	2	6	52	9	0	69
	YJA02	1	8	45	10	0	64
	YJA03	2	5	58	13	0	78
	YJA04	2	6	47	14	0	69

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

Table 9-Huangdao fishing boat mutual rescue team

Mutual rescue communities	Mutual Rescue Team	Length(m)					Total
		0-10	10-20	20-30	30-40	40-50	
Huangdao	YJB01	56	2	1	0	0	59
	YJB02	60	2	1	0	0	63
	YJB03	69	2	1	0	0	72

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

Table 10-Jimiya fishing boat mutual rescue team

Mutual rescue communities	Mutual Rescue Team	Length(m)					Total
		0-10	10-20	20-30	30-40	40-50	
Jimiya	YJC01	91	59	20	0	1	171
	YJC02	94	63	17	1	1	176
	YJC03	96	55	22	1	1	175
	YJC04	90	67	19	1	1	178
	YJC05	101	59	21	0	1	182
	YJC06	89	56	16	1	1	163
	YJC07	88	61	16	1	1	167
	YJC08	93	66	21	1	1	182
	YJC09	95	55	16	0	1	167
	YJC10	100	70	20	1	1	192

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

Table 11-Luojiaying fishing boat mutual rescue team

Mutual rescue	Mutual Rescue	Length(m)					Total
		0-10	10-20	20-30	30-40	40-50	

communities	Team						
Luojiaying	YJD01	15	34	20	3	0	72
	YJD02	13	37	17	2	0	69
	YJD03	16	33	16	3	0	68
	YJD04	15	35	21	3	0	74
	YJD05	12	34	19	3	0	68
	YJD06	14	33	17	3	0	67
	YJD07	13	36	16	2	0	67
	YJD08	14	30	18	3	0	65
	YJD09	17	31	16	3	0	67
	YJD10	13	34	15	3	0	65

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

Table 12-Nvdao fishing boat mutual rescue team

Mutual rescue communities	Mutual Rescue Team	Length(m)					Total
		0-10	10-20	20-30	30-40	40-50	
Nvdao	YJE01	89	12	2	0	0	72
	YJE02	87	9	2	0	0	69
	YJE03	83	11	3	0	0	68
	YJE04	91	10	2	0	0	74
	YJE05	89	12	2	0	0	68
	YJE06	85	10	1	0	0	67
	YJE07	92	11	3	0	0	67
	YJE08	93	9	2	0	0	65
	YJE09	81	10	2	0	0	67
	YJE10	83	13	2	0	0	65

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

Table 13-Shazikou fishing boat mutual rescue team

Mutual rescue communities	Mutual Rescue Team	Length(m)					Total
		0-10	10-20	20-30	30-40	40-50	
Shazikou	YJF01	63	8	8	1	1	81
	YJF02	75	9	6	2	1	93
	YJF03	69	11	9	2	1	92
	YJF04	73	10	7	2	1	93
	YJF05	67	9	7	2	1	86

	YJF06	70	9	9	1	1	90
	YJF07	72	10	6	2	0	90
	YJF08	67	8	8	2	0	85
	YJF09	64	9	8	2	0	83
	YJ10	71	10	7	2	0	90

Source: Created by Author according to data from Qingdao Ocean Development Bureau.

(3) Establishment of a dynamic mutual rescue mechanism in fishing areas

Considering the dynamic nature of fishing boats, fishing boats that are in the same mutual rescue team may be far away. In order to further increase the scope and depth of mutual rescue, as well as improving the SAR success rate, relying on the fishing boats operating area (as shown in Figure 19), a dynamic mutual rescue guarantee mechanism was established in the fishing area. The author regarded each fishing area in the Qingdao Maritime SAR area as a dynamic SAR unit and compiled fishing boats operating in the same fishing area into the same dynamic mutual rescue team, and the number was named after the fishing area number.

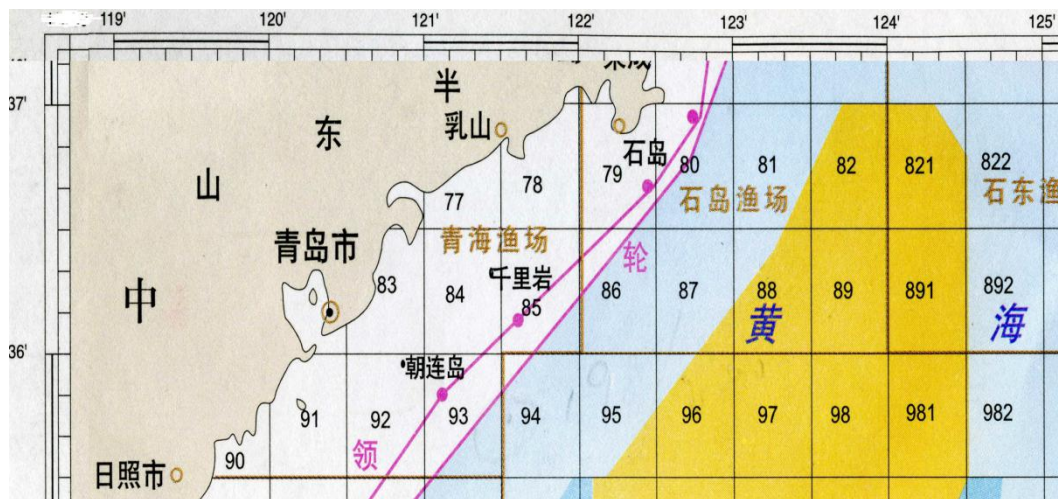


Figure 19-Grid management of fishing areas

Source: Qingdao MSA.

(4) Establishment of a dual mutual rescue system

The fishing boat mutual rescue community and mutual rescue team are used as a static mutual rescue system, and the fishing area mutual rescue team is used as a dynamic mutual rescue system, and the two are combined to form a fishing boat dual mutual rescue system, as shown in Figure 20.

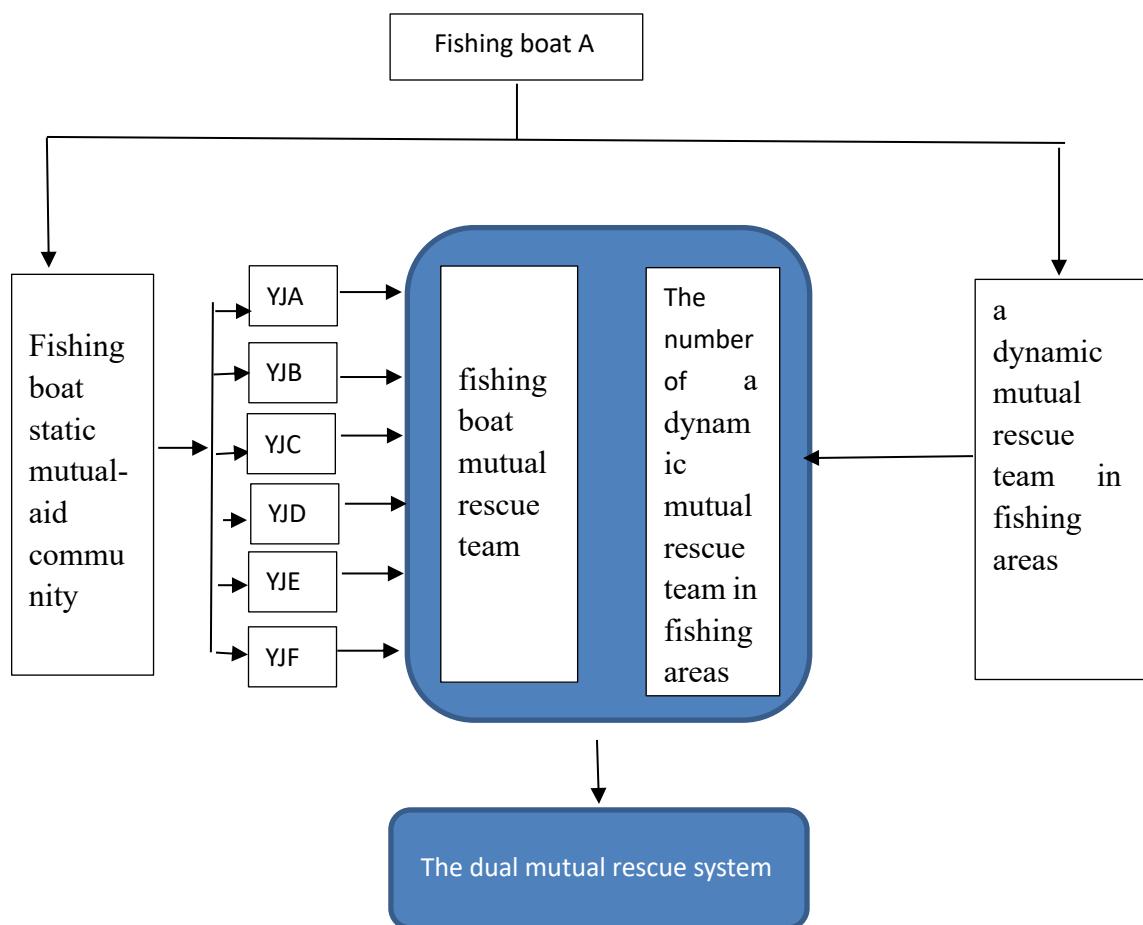


Figure 20-The dual mutual rescue system
Source: Author.

CHAPTER 5 CONCLUSION

5.1 Conclusion

The frequent emergencies of fishing boats have aroused widespread concern in society and become a serious social problem. As fishing boats have a relatively wide range of operations, they also bring great challenges to supervision. In addition, the level of education of fishermen is relatively low, and their safety awareness is relatively weak. As the construction of professional rescue forces is expensive, the problem of insufficient professional rescue assistance is difficult to improve in a short time. Objectively speaking, the frequent occurrence of fishing boats in danger and the difficulty of rescue will exist for a long time in the future.

This paper started with a case analysis of fishing vessel SAR, configuration of professional SAR forces and related questionnaire survey, clarified the current problems of fishing boats related SAR and put forward a number of practical suggestions, such as: strengthening the system construction of the SAR centers, optimizing the standby point of professional rescue forces, etc. The core point of this paper was that it was very important to improve the self-rescue and mutual rescue capabilities of fishing boats, and targeted solutions were proposed.

5.2 Limitations

Due to some restrictions, during the writing of this paper, the author was unable to obtain relevant data from other SAR centers, which resulted in relatively non-diversified data in this paper. In addition, the operations of fishing boats at sea are more chaotic and disorderly than expected, so the method proposed in this paper needs further verification.

As a staff member of Qingdao MSRC, in the future work, the author will try to cooperate with other SAR centers, such as Guangdong in the south and Heilongjiang in the north to do more in-depth and detailed research to solve the problems in this paper.

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APPENDIX A

Questionnaire

The purpose of this questionnaire is to provide a theoretical basis for the formulation of first aid training programs and operating production specifications for fishermen. The method is anonymous. Please feel free to answer.

I. Demographic characteristics

1. Age

A. 20-29 B. 30-39 C. 40-49 D. 50-59 E. 60-65

2. Education level

A. Elementary school and below B. Junior school

C. High school and above

3. Type of work

A. Captain B. Chief Engineer C. Sailor D. Others

4. Whether participated in training

A. Yes B. No

5. Whether participated in first aid

A. Yes B. No

II. Situation of first aid

1. Have you suffered any accidental injuries during fishing in the past year?

A. Yes B. No

2. Type of accidental injury

A. Fall B. Blunt force injury C. Burn D. Poisoning

E. Injury caused by broken rope F. Sharp force injury G. Bite injury

3. Do you know the phone number for maritime SAR?

A. Yes B. No

4. Operation of communication equipment

A. Totally can't B. Simple operation C. Skilled

5. Equipped with first aid kit

A. None B. Equipped but lack of items C. Equipped with sufficient items

6. First rescuer

A. Colleagues on board B. Doctors from shore C. Seamen nearby

III. fishermen' first aid knowledge

(1) Multiple choice question

1. Dactylic acid hemostasis is applicable ()

- A. Smaller veins B. Medium or large veins
 - C. Smaller arteries D. Medium or large arteries
2. Fixation after a fracture, which one is correct? ()
- A. Should exceed the joints at both ends of the fracture site
 - B. The bandage should be tightened as much as possible
 - C. Put more cloth between the splint and the limb
 - D. When there is a wound, do not fix it
3. In case of limb dismemberment injury, how to deal with the dismemberment? ()
- A. Put it in ice cubes
 - B. Rinse it with water and wrap it then take it to the hospital with the wounded
 - C. Wrap in a clean cloth, place it in a plastic bag and store it in a plastic bag filled with ice (2-3 degrees Celsius)
 - D. Wrapped in cloth
4. Which first aid should be given to patients with open fractures accompanied by arterial bleeding and shock
- A. relieve pain B. stop bleeding C. Fixed fractures D. Wrap the wound
5. Symptoms of oil and gas poisoning:
- A. dizziness B. Lost the will C. Flustered D. all of the above
6. Most important first aid treatment for epilepsy patients is () 。
- A. Give the patient pills quickly
 - B. Medical massage
 - C. Keep respiratory tract open to prevent asphyxia
 - D. Ask for a detailed medical history
7. which operation is wrong regarding first aid for cerebral hemorrhage ()
- A. When the patient appears unconscious, shake the patient vigorously.
 - B. In case of coma snoring, should try to use a handkerchief or gauze wrapped around the patient's tongue, gently pull the patient's tongue out
 - C. If the patient has convulsions, two bamboo chopsticks or small wooden sticks can be taken, wrapped in cotton cloth and stuffed into the upper and lower teeth of the patient
 - D. In case of sudden cerebral hemorrhage and asphyxia, the family members should empty the foreign body in the patient's mouth as soon as possible and give artificial respiration

(2) True or false

- 1. The broken end of the fracture should be immediately brought back into the wound, so as not to cause wound infection. ()
- 2. When rescuing a patient with hydrogen sulfide poisoning, first remove the patient from the scene and place him downwind. ()

3. When the burn wound is in the scene of first aid, it only needs to be no longer contaminated, no longer damaged, not coated with any drugs, avoid using colored drugs daub, so as not to affect the diagnosis of wound depth. ()
4. When rescuing the injured with shock, we should take the concave position. ()
5. The necessary symptoms to determine cardiac arrest: loss of aortic pulse, loss of consciousness, sighing of breath. ()
6. When the drowning person does not breathe or have a heartbeat, it is advisable to immediately drain the drowning person immediately. ()

IV Current status and needs of first aid training

1. Cumulative training times
 - A. None B. one C. two D. three E. Four and above
2. Reasons influence training participation
 - A. No interest
 - B. No time
 - C. It doesn't help
 - D. The way of implementation is not attractive enough
3. Are you willing to participate in training
 - A. No B. Yes C. don't care
4. Contents of the training you wish to attend
 - A. CPR trauma first aid
 - B. First aid for burns
 - C. First aid for poisoning
 - D. Escape from a fire
 - E. Get an electric shock first-aid
 - F. Drowning first aid
 - G. Field disaster assessment techniques
 - H. The other
5. Form of training
 - A. Teacher's explanation and practical operation
 - B. Multimedia lecture
 - C. Multimedia lectures and exercises
 - D. Watch the videos
 - E. others
6. expected frequency of training
 - A. Once every 6 months B. Once every 12 months C. Once every 24 months
 - D. Once every 36 months E. Once every 60 months F. Never minds

APPENDIX B

One of 143 SAR records analyzed by the author (part)

SAR RECORD			险情处置记录		
Time	Process	Recorder	时间	处置过程	记录人
2016-01-26 08:25:50	12395 Received the distress report, Mr. Wu (telephone number) reported that a fisherman on board (name of fishing boat) had his hand broken and was in shock. The location was 123° 40' East, 36° North. The specific position is unknown. There were 10 people on board, Beidou (beidou number), satellite phone (satellite phone number).	Yu	2016-01-26 08:25:50	12395 接警, 乌先生 1234567890 报警称渔船上有一名渔民手断, 已休克, 位置经度 123 度 40 分, 纬度 36 度, 具体不详, 船上 10 人, 北斗 1234567890 卫星电话 1234567890	
2016-01-26 08:29:50	The duty officer contacted Mr. Li from Qingdao Fishery Bureau to inform the distress situation and asked whether he can find the specific location of the ship through Beidou. Mr. Li asked the duty officer to contact the fishery bureau's SAR phone (phone number).	Yu	2016-01-26 08:29:50	电话联系青岛市渔业局李, 将险情情况告知, 询问其能否通过北斗找到船舶具体位置。被告知请联系渔业局分管搜救电话 856621234567890	
2016-01-26 08:32:50	The duty officer telephoned Mr. Li, the duty officer responsible for SAR of Qingdao Fishery Bureau, to inform him of the emergency. Mr. Li told the duty officer of the SAR center office that the fishing boat was not of Qingdao nationality and could not obtain its location.	Yu	2016-01-26 08:32:50	电话联系青岛市渔业局搜救李, 将险情情况告知, 被告知该船非青岛渔船, 无法获取其位置, 建议联系江苏渔业部门。	
			2016-01-26 08:45:50	联系北海救援值班, 将险情情况告知, 具体位置仍在核实, 建议其通知飞行队备飞, 谢	